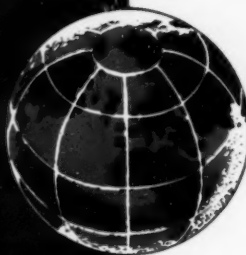


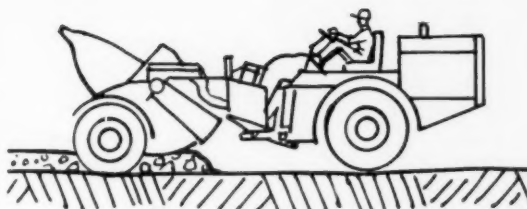
MINING WORLD



JANUARY
1960

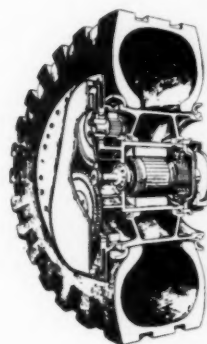
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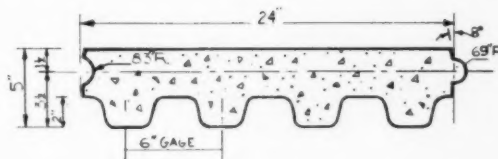
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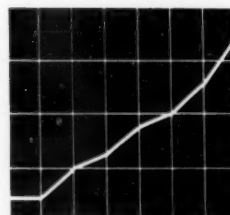
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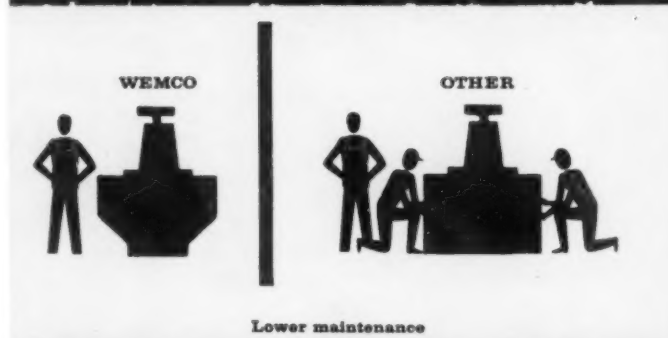
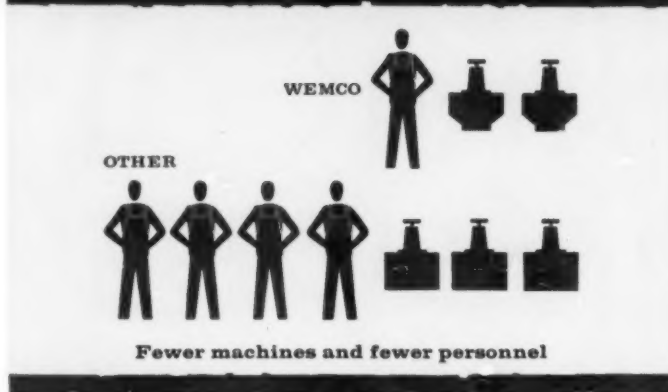
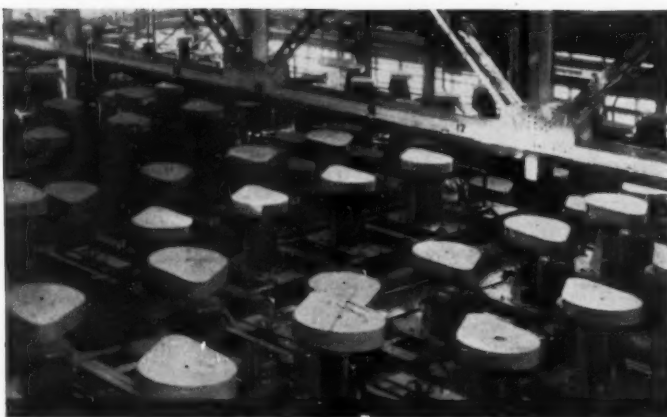
LABOR REQUIREMENTS REDUCED, MAINTENANCE COSTS CUT... WITH WEMCO-FAGERGREN FLOTATION

Wemco-Fagergren equipment costs less, *much* less, to operate! Operating labor is reduced because Fags need little or no adjustment to compensate for feed variations. Simplicity of design and operation assures fewer maintenance problems—and less cost. There is less wear and replacement of parts, less downtime because wear-exposed parts are rubber covered and an entire mechanism is easily removed for inspection and repair without shutdown of pulp flow.

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- (4) Convenient controls, automatic back head!***
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**LESS DOWN TIME,
MORE PRODUCTION...
CAT MOTOR GRADERS**



Canadian Tungsten Discovery looks important as drilling indicates over 1,000,000 tons of high grade scheelite ore which can be mined by open pitting. Discovery made in Northwest Territory 29

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MILLER FREEMAN PUBLICATIONS



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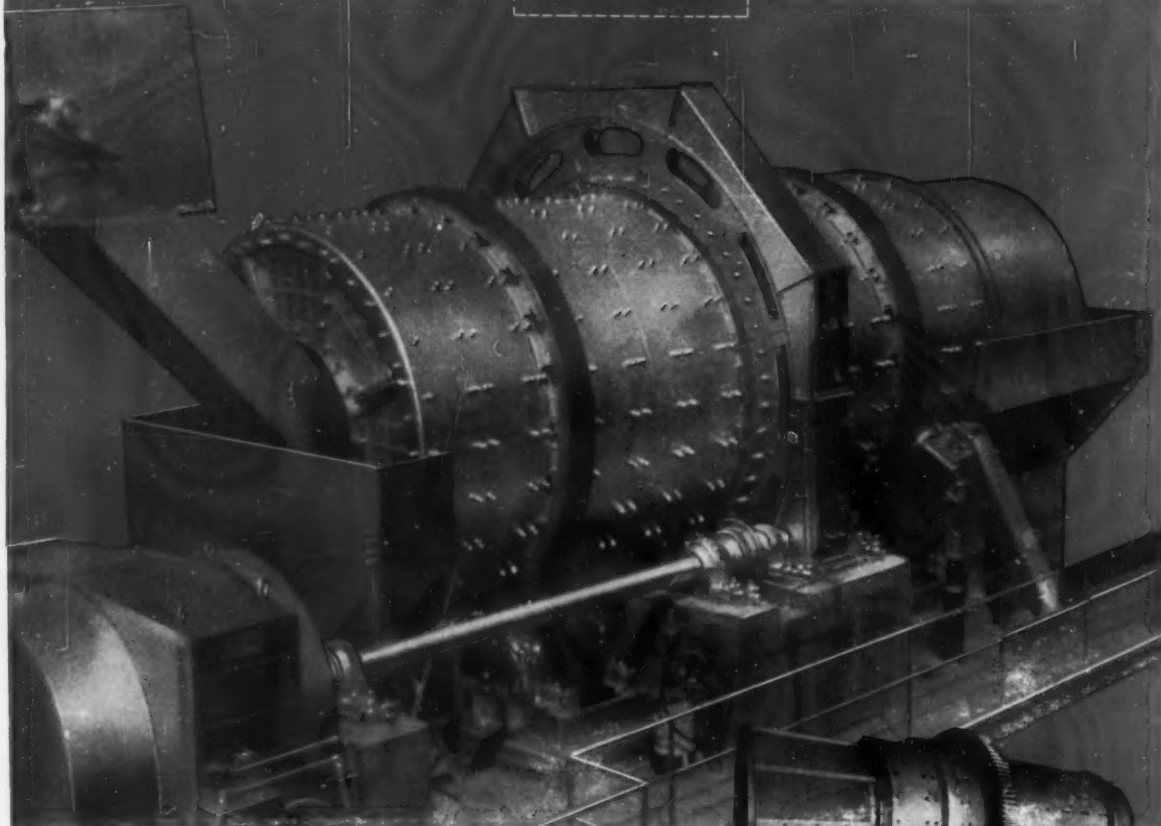
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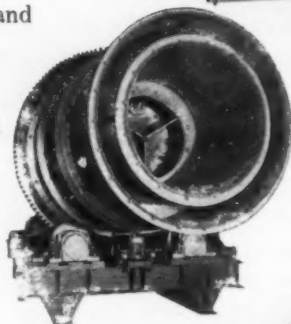
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◆ View showing rotary kiln type carrying stations with spherical roller bearing pillow blocks and extra heavy base.

◆ Discharge end of scrubber with double trommel. Dirt and clay wash through outer trommel; sized material discharges off end. Oversize discharges off end of inner trommel.



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500 Howard Street
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EXbrook 7-1881

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Editor George O. Argall, Jr.
Associate Editor Stanley Dayton
Mgr., Engr. Services H. G. Grundstedt
News Editor Janet M. Taylor
Assistant News Editor L. B. Robinson
Product Editor Suzanne Matsen
Production Manager Charlotte E. Smith
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Circulation Manager C. C. Baake
Field Circulation Mgr. C. S. Denny

New York City Office
370 Lexington Avenue
New York 17, New York
Murray Hill 3-9295
District Manager A. E. Roberts

Chicago Office
1791 Howard Street
Chicago 26, Illinois
Rogers Park 4-3420
District Manager Norman C. Ek

Vancouver, B. C. Office
402 Pender St. West
Vancouver, British Columbia, Canada
MUtual 5-7287
Cable Address: MILFREEPUB
Associate Editor Charles L. Shaw
Vice President International Operations
Miller Freeman Publications
Max F. Holsinger

United Kingdom Office
130 Crawford Street
(Corner Baker Street)
London, W. 1, England
WEIbeck 3624
Cable Address: MILFREEPUB
Manager, United Kingdom Office
Bernard W. Lansdowne

Continental European Office
28 Attendorfer Street
Köln-Merheim
West Germany
Telephone: 87-17-52
Cable Address: MILFREEPUB
Director, Continental European Operations
Dr. Walter F. Vogeno

STAFF CORRESPONDENTS: Africa—Johannesburg, Union of South Africa; Salisbury, Southern Rhodesia; Luanshya, Northern Rhodesia; Kampala, Uganda. Asia—Ankara, Turkey; Kuala Lumpur, Malaya; Bombay, India; Tavoy, Burma; Karachi, Pakistan; Seoul, Republic of Korea; Tokyo, Japan. Europe—London and Redruth, England; Vienna, Austria; Stockholm, Sweden; Trondheim, Norway; Paris, France; Madrid, Spain; Köln-Kalk (Cologne), West Germany; Rome, Italy. North and Central America—Vancouver, British Columbia; Mexico, D.F., Mexico. Oceania—Port Kembla, Australia; Manila, Republic of the Philippines; Bandung, Indonesia. South America—Lima, Peru; La Paz, Bolivia; Buenos Aires, Argentina; Santiago, Chile; La Serena, Chile.

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DRIFTS AND-CROSSCUTS

Why Depletion

The House Committee on Ways and Means has been conducting hearings on Income Tax Reform in Washington, D. C. The purpose of these hearings is to get at the basic question "of whether or not various policies incorporated in the Internal Revenue Code should be in our tax law at all."

There is no need to repeat here the history of depletion and its incorporation in the tax laws. However, it is a good thing for everyone in the mining industry to remember the Congress' historical policy of encouraging the necessary exploration for, and development of, our natural resources as written into law in the Revenue Act of 1918 as follows:

The prospector for mines frequently expends many years and much money in fruitless search. When he does locate a productive property and comes to settle, it seems unwise and unfair that his profit be taxed at the maximum rate as if it were ordinary income attributable to the normal activities of a single year.

Just how long, difficult, and expensive it is to find a productive property was carefully detailed by L. J. Randall, president, Hecla Mining Company, Wallace, Idaho.

He said that from 1944 through 1958 Hecla geologists examined 890 properties at a preliminary cost of \$302,000. Only 13 were selected as worthy of further and more extensive exploration and on these an additional \$3,718,000 was spent. Exploration has been completed on all, and only one of the 13, the Radon uranium mine near Moab, Utah, has been profitable.

The case for the iron miner was outlined by Herbert C. Jackson, associate managing partner, Pickands Mather & Co., Cleveland, Ohio, who reported that "one of the major concerns and expenses of the mining industry is the exploration for new mineral deposits." Exploration grows more difficult and costly every day: "Since the time percentage depletion was first allowed as a deduction, costs of exploration have more than quadrupled."

He added that in 12 years, to 1958, companies operated by P-M examined more than 1,109 iron-bearing prospects in Minnesota, Michigan, Wisconsin, and Canada. Only 65 of these, warranted further intensive exploration. About \$8,-100,000 was spent on this exploration to find only 12 which appeared commercial. Only three of these were discovered outside the iron formation on known ranges.

A wise Congress, for over 40 years, has encouraged prospecting. The depletion allowance has played a major part in providing the United States with its present ore reserves.

Mr. Jackson continued, "The policy of encouraging the exploration and development of our natural resources is amply justified under present conditions. If anything, due to depletion of much of our natural resources, accelerated by two world wars, it is even more vital to our national security today to continue to encourage exploration and development than when the policy was adopted."

Write your Senator, write your Congressmen, write Representative Mills that depletion must be maintained to make the United States strong mineralwise.



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Ohio River Collieries, Cheshire, Ohio carries 240 tons of coal every day with each of their Fuller ROADRANGER®-equipped Diamond T Model 950-56M dump trucks.

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Ohio River Collieries' General Manager Tony Gentile says, "With our ROADRANGER-equipped Diamond

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CAPITOL CONCENTRATES



Miner Has Free-Access Rights

The solicitor of the Department of the Interior has ruled that the United States mining laws give to the locators and owners of mining claims, as a necessary incident, the right of ingress and egress across public lands to their claims for the purpose of maintaining the claims and as a means of removing the minerals. Since this is a statutory right, he stated, use fees may not be charged for roads constructed pursuant to this right.

The ruling was issued after representatives of an Oregon mining claimant protested an attempt by the Bureau of Land Management office in Oregon to levy a charge for the use of a road the company had constructed in the 1890's across government land and had maintained and used since that time.

"Executive action along the line proposed could be used to completely destroy the rights granted by Congress under the mining laws," the solicitor explained. "The grant of the minerals with all incidents thereunto pertaining is direct from Congress to the miner. The act contains no language that could be construed to authorize a federal agency to make a charge in such a case."

If a miner wishes to use a road built or acquired by the United States, or if he applies for and obtains a right-of-way which would grant him exclusive use, he must pay whatever fees are required, the ruling continued. Also, if a miner builds a road "he is liable in damages if he unnecessarily causes loss or injury to the property of the United States, and his right to use the road, even though he built it, is not exclusive but his right to use it for mining purposes is as evident as his right to mine."

Roads constructed across the public domain by mining claimants are in the nature of "private roads" across another's land, the ruling concluded. "The United States can no doubt use such a road or permit its permittees or licensees to do so, at least to the extent that it does not unduly interfere with its use for the legitimate purpose for which it was built."

Tariff Hearings Held On Zinc Sheets

Early in November, the U. S. Tariff Commission conducted hearings in connection with an escape-clause investigation as to whether imports of coated and uncoated zinc sheets are causing or threatening serious injury to the domestic industry producing these articles. The investigation was requested last July by Ball Brothers Company, Illinois Zinc Company, and Matthessen and Hegeler Zinc Company.

Burnham B. Holmes, representing Ball Brothers, said imports which accounted for only 1 percent of domestic production in 1952 rose to 21 percent by 1958. He asked the commission to recommend an increase in the duty to 46.9 percent ad valorem—the maximum which the commission can recommend to the President under the Trade Agreements Extension Act.

C. E. Schwab, who appeared in behalf of the Emergency Lead-Zinc Committee, asserted that "imports of zinc sheets, or any zinc manufacture, will serve to dilute the

available market in the United States for zinc produced from Domestic Mines.

Under law, the Tariff Commission has six months—or until January 14—to submit its findings and recommendations to the President.

"Free" Silver Regulations Explained

There has been considerable discussion among silver producers over the increasing shortage of Treasury "free" silver. The general notion seems to be that, if the "free" silver is used up in coining subsidiary coins, the Treasury will have to purchase silver on the open market.

A recent statement from the Treasury says: "Existing legislation does not prevent the retirement of silver certificates and the use of the silver thus freed for the manufacture of subsidiary coins."

However, should the "free" silver stock run so short that there was not enough to sell to industry, silver freed by retiring silver certificates would have to be sold for \$1.29 per fine troy ounce or the government would suffer a loss. Clearly, then, although there would be no trouble in finding silver for the subsidiary coinage, the industrial or market price would stand a good chance of advancing if the Treasury ran short of "free" silver.

Protest Uranium Depletion Proposal

Twenty-five U. S. Senators from 14 states, in a telegram to Secretary of the Treasury Robert B. Anderson, expressed deep concern over the tentative decision of the Internal Revenue Service that "concentrating" is not a mining process in the uranium industry.

"The proposal does violence not only to long-standing rulings and decisions of the Internal Revenue Service, but also to the intent of the Congress," they stated. "For many years the Internal Revenue Service has taken the position that concentrating of uranium ores into yellowcake is an 'ordinary treatment process' for the purpose of determining the gross income from mining on which percentage depletion is based."

The Senators recommended the following:

1. The treatment of concentrating uranium ores into yellowcake as an ordinary treatment process for depletion purposes should not under any circumstances be revoked retroactively—to do so would amount to a breach of faith by the government; and

2. As to future treatment of this problem, no adverse decision should be made without first calling the matter to the attention of Congress for its consideration.

Disposal Of Nicaro Facilities Delayed

Expressions from the Cuban government that it may want to bid for and take over the Nicaro nickel facilities in Cuba are said to have halted our government's attempts to dispose of that enterprise. No doubt, Cuba's bid will be in 25-year Cuban bonds, the value of what at that time would be questionable.

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New Standards of

Plus the exclusive advantages of KON-TORK differential . . . a combination that means extra profit capacity for you—loading, hauling and spreading.

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The new 360 gives you more big-production features than any other big scraper, too: high-torque engine characteristics and snappy acceleration . . . full 90° steering . . . 10-ft apron lift . . . torque-proportioned traction . . . *plus* the new standards of all-hydraulic performance spotlighted at the right.

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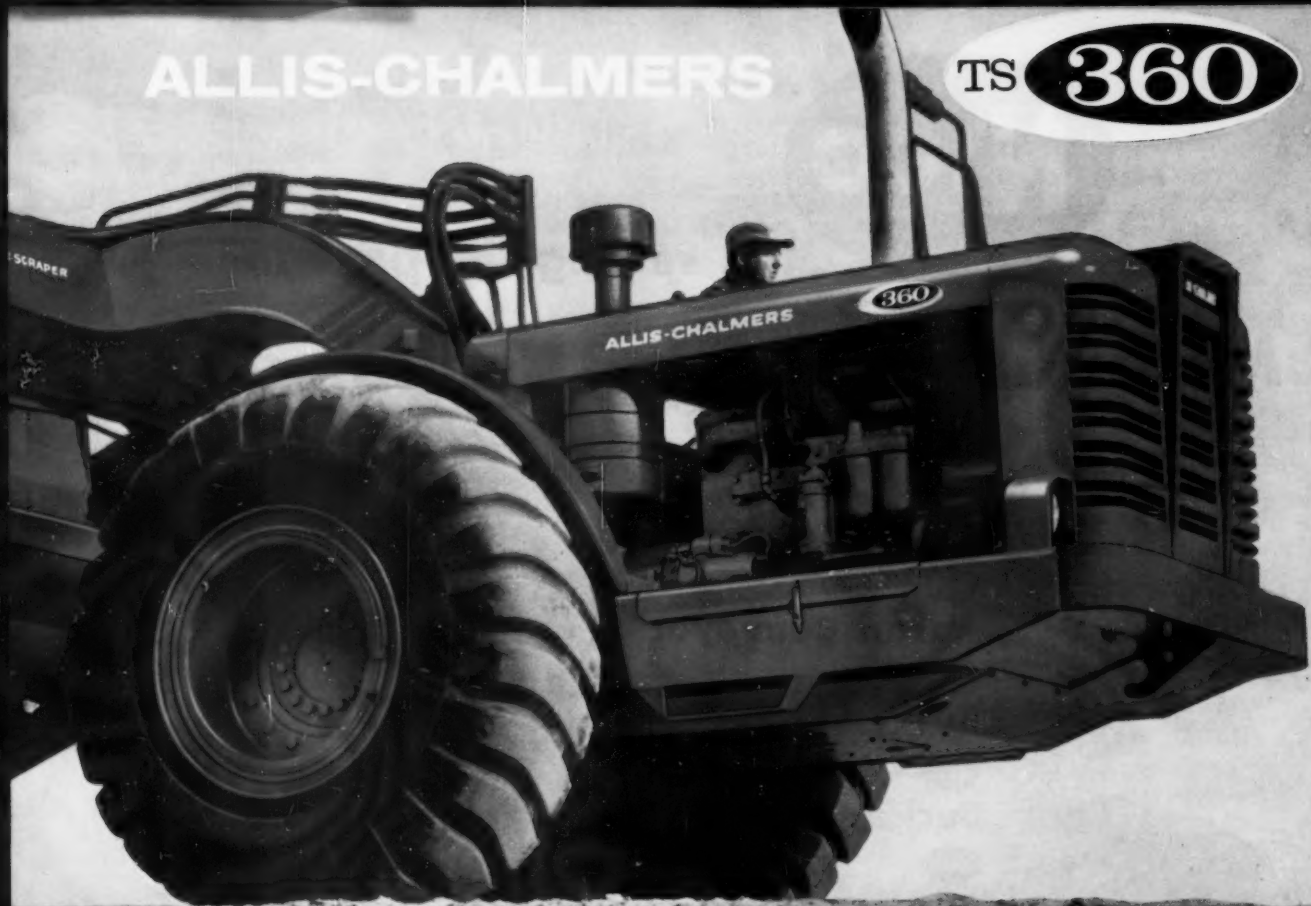


Double-acting bowl jacks put enough penetrating force on the cutting edge to pivot the scraper and its load clear of the ground.

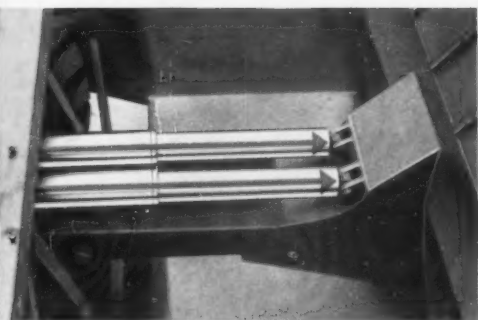
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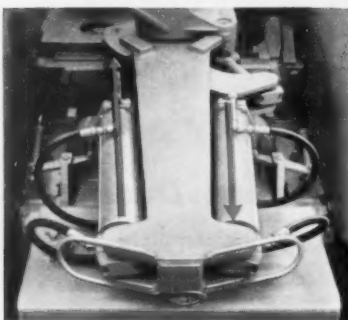
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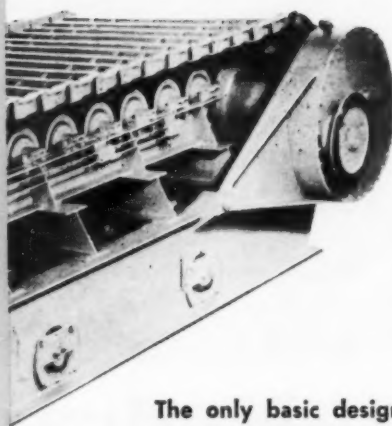
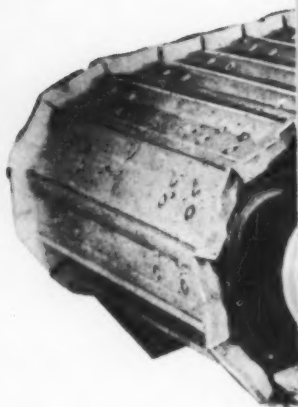
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LATE NEWS SUMMARY . . .

\$6,704,000 MANGANESE REFINERY PROPOSED FOR ROCKY MOUNTAIN REGION . . . Standard Uranium Corp. has agreement to supply rhodonite $[(Mn, Fe, Ca)SiO_3]$ ore from mine and mill at Silverton, Colorado where it is reopening Sunnyside mine. Unidentified eastern firm will build refinery in Utah or Colorado—final site not decided.

SIX JAPANESE FIRMS WILL MINE BOLIVIAN COPPER DEPOSIT . . . Nitton Bolivia Mining Co. has been formed to develop Chacarilla mine 90 miles southwest of La Paz with \$1,116,694 capitalization.

A MILLION DOLLAR FLOTATION PLANT . . . will be built in Middletown, Connecticut by the Feldspar Corporation. Production should start in the fall, with ore coming from firm's own property nearby.

MOROCCO WANTS PARTICIPATION IN COUNTRY'S MINING OPERATIONS . . . More and more firms are accepting government nominees on their boards of directors. Begins to appear as though government won't consider new mining investments without government share in profits.

COLORADO'S FRONT RANGE URANIUM DISTRICT NOW GUARANTEED A MARKET . . . for its ores. The AEC has signed a new contract with Cotter Corp. leading to expansion of that firm's mill from 50 to 200 tons daily. Concentrate sales contract runs to Feb. 28, 1965, and not through Dec. 31, 1966. Mill could also handle ore from Pinnacle Exploration in Gunnison County,

ZINC DEMAND HAS BEEN SO GOOD . . . that both American Smelting and Refining Co. and Bunker Hill Co. are operating zinc refineries at capacity. ASARCO's Corpus Christie, Texas plant is producing an additional 3,000 tons a month of Special

High Grade. Bunker Hill's electrolytic plant has added 1,200 tons a month to Kellogg, Idaho output. Depletion of stocks, strike at Anaconda's two Montana refineries, and increased automobile production have played major part in increased demand.

WORLD'S GREATEST LITHIUM STOREHOUSE . . .

Bikita pegmatite in Southern Rhodesia, now completely owned by Bikita Minerals (Private) Ltd. The just purchased northern section contains large reserves of petalite, spodumene, and eucryptite. Bikita already produces amblygonite and lepidolite from southern section. Now Bikita offers all types of lithium ores from one mine.

IRON ORE MINERS GOT A BREAK . . . with warm

December weather which made possible history's latest shipments from Duluth. Looks like a total of about 56,500,000 tons shipped down lakes will carry steel mills over until spring.

START OF 1960 PROVES 10-YEAR-OLD PREDICTION . . . for 1,000,000,000 tons of high-

grade iron ore in Venezuela has come true. Latest drilling by government at San Ysidro deposit shows 8,000,000 tons per meter of depth and it looks as though 60 meters can be mined.

FIRST COPPER SMELTER IN SOUTHWEST AFRICA . . .

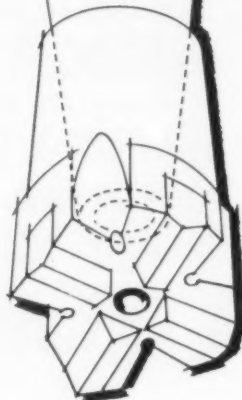
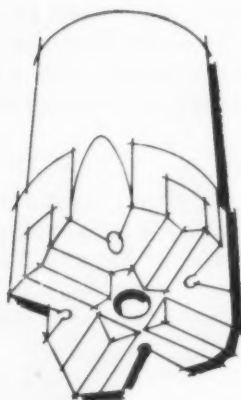
Tsumeb Corporation will build it and start operations in 1962. In addition to treating company's concentrates, smelter will handle custom ore. Design will allow an addition for lead smelting later, if desired.

LUCKY MC NAME WILL DISAPPEAR FROM MINING SCENE . . . as Utah Construction and Mining Co. prepares to absorb it.

Lucky Mc directors have approved merger. No question but that stockholders will also approve it. Lucky Mc was one of greatest examples of "Strike It Rich" in uranium boom. Neil McNeice, part-time prospector, found Lucky Mc which grew in to Gas Hills mining district. While Lucky Mc is gone, the name will be long remembered in mining.



Removable yet one-piece strong



**That's why
Timken®
air-leg bits
save you time
and money**

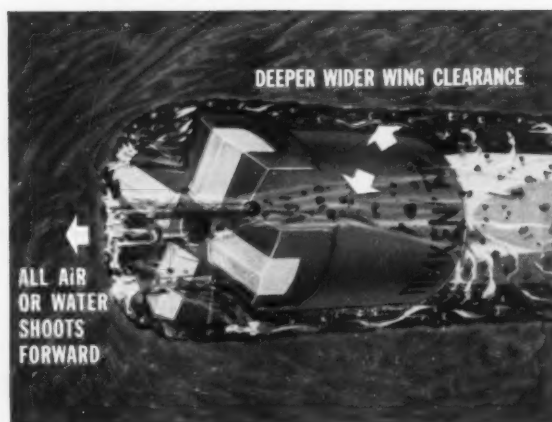
YOU can keep right on using your good drill steels after the carbides wear out—if you're using Timken® bits. They're removable. Not so with intrasets; you have to throw away good drill steels after the carbides wear out.

You need only a pocketful of Timken removable bits for a whole day's work. You have to lug at least an armful of intrasets to the face.

You can change bit gauge sizes fast on the same steel when you use Timken air-leg bits instead of changing the whole steel.

You take *only* the Timken removable bits to the shop for resharpening—don't have to wrestle the whole steel. What's more, Timken bits give longer gauge wear because there are four carbide cutting edges. Most intrasets have only two. And for extra bit strength and life, Timken bit bodies are made of tough, Timken fine alloy steel.

To cut your drilling costs use the TTC—the air-leg bit that's tapered for one-piece strength. It also gives you faster chip clearance (see diagram at right). Send for free brochure on the Timken tapered socket carbide insert bit. Write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO". Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.



CHIPS CLEAR FASTER because 1) Five front holes shoot water or air directly against the rock face and 2) Deeper, wider wing clearance lets chips wash back faster.

TIMKEN®
removable rock bits

MINING WORLD



"Modern Copper Concentrator at Silver Bell, Ariz., for American Smelting & Refining Company"

FROM START TO START-UP

Planning for successful operation begins with preliminary designs and cost estimates. From start to production, assign Stearns-Roger the task—one order, one responsibility for design, engineering, procurement and construction. For new plant or modification,

TAKE IT UP WITH...

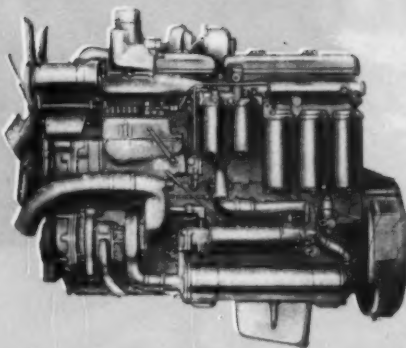
Stearns-Roger
THE STEARNS-ROGER MFG. CO. • DENVER, COLORADO

DENVER • HOUSTON • SALT LAKE CITY • EL PASO
 Stearns-Roger Engineering Company, Ltd., Calgary, Alberta

Planet power steering with gives new 230-hp TD-25 class-topping



Here's the new direct-start 6-cylinder turbocharged International DT-817 diesel that powers the TD-25. Dual valving of this high-torque 230-hp power plant provides for peak turbocharging efficiency, for full power delivery from sea level to timberline!



built-in power-shifting

capacity!

You get combined Planet Power-steering and Hi-Lo on-the-go power shifting exclusively in the new International TD-25 crawler. As standard equipment at no extra cost, the TD-25 gives you the International-developed control combination that has been beating the daylights out of king-sized clutch-steered crawlers for years!

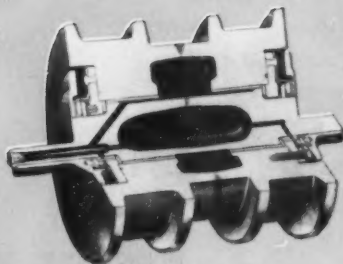
With this and all its other big advantages, the TD-25 can outearn other big rigs up to 50%—on highwalling, benching and side-casting, as well as on straight dozing to remove overburden, or to harvest minerals or building materials!

No "dead-track drag" or "gear-shift lag"! Planet Power steering gives you full-time "live" power and traction on both tracks to make full-load turns—and eliminate load-limiting dead-track drag. And Hi-Lo on-the-go power shifting instantly matches power to condition to prevent load-losing "gear-shift lag." You power-steer and power-shift the new "25" with 2-finger ease!

Hi-Lo power-shifting makes the TD-25 the industry's only 4-speed torque-converter crawler, and the only one with load-matching efficiency-range control. In the synchromesh transmission TD-25, the Hi-Lo planetary system gives eight speeds forward and reverse—with cycle-speeding up-or-down, on-the-go shifting!

Power-shift and power-steer the new TD-25 with full king-size loads—around curves, upgrade, anywhere. See what it means to command full-time, full-load ability to outearn clutch-steered king-size crawlers up to 50%. See your International Construction Equipment Distributor for a demonstration!

Keep full loads on the move full time with exclusive Planet Power steering. Full power on both tracks full time is the answer! Hi-Lo, on-the-go power-shifting lets you match power to condition—instantly—and keep the yard-boosting advantage of uninterrupted momentum. On benching or highwalling, simply operate the bank-side track in high speed range, while keeping the outside track in low range—for full-bite, full-blade performance.



Thickest-shelled roller design in the crawler industry—with king-size lube reservoirs and seal-protecting pressure-relief passages—combine to make TD-25 Dura Rollers the ones you can power-lubricate without affecting seal life or efficiency!



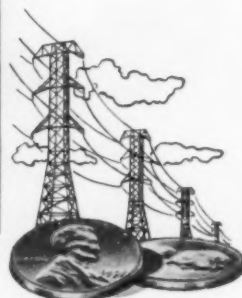
International Construction Equipment

International Harvester Co., 180 North Michigan Ave., Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors... Self-Propelled Scrapers and Bottom Dump Wagons... Crawler and Rubber-Tired Loaders... Off-Highway Haulers... Diesel and Carbureted Engines... Motor Trucks... Farm Tractors and Equipment.



Copper

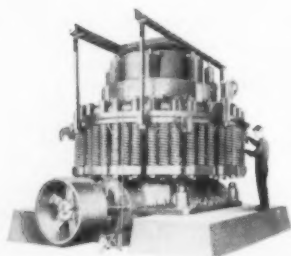


... symbol of money and power

The name *copper* is from the Greek *κυπρος*, Cyprus, one of the early sources of the metal. Copper has often been called "the common man's gold"—and has become a symbol of *money* due to its wide usage in the coins of many nations, as well as a symbol of *power*—since the greatest usage of copper has been as a conductor of electricity.

While native copper is the only metal found abundantly in nature, commercial production is supplied chiefly from various ores of copper, including chalcopyrite, chalcocite, cuprite and malachite.

Wherever these copper ores are processed—in Arizona, Chile, or the Belgian Congo—you'll find Symons Cone Crushers the leading choice among the world's prominent producers. For in copper . . . *as in all of the important ore and mineral operations around the world* . . . Symons Cone Crushers have consistently maintained their prominent position by efficiently processing large tonnages of finely crushed product at low cost.



SYMONS® CONE CRUSHERS

... The machines that revolutionized crushing practice . . . are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.

SYMONS . . . a registered Nordberg trademark
known throughout the world

NORDBERG MFG. CO., Milwaukee 1, Wisconsin

©1959, N. M. CO.

C659

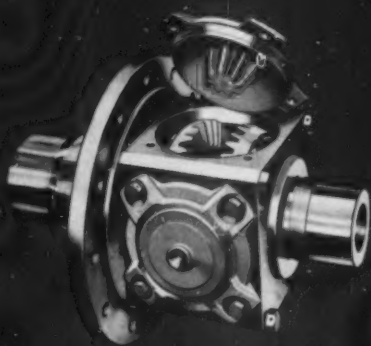
NORDBERG



ATLANTA • CLEVELAND • DALLAS • DULUTH • HOUSTON • KANSAS CITY • MINNEAPOLIS • NEW ORLEANS • NEW YORK • ST. LOUIS
SAN FRANCISCO • TAMPA • WASHINGTON • TORONTO • VANCOUVER • JOHANNESBURG • LONDON • MEXICO, D. F.



HYDRAIR*



POWER-TRANSFER
DIFFERENTIAL

How these
exclusive
advantages
**help you
cut hauling
costs...**



Haulpak®

These **3** cost-cutting advantages...



LW HAULPAK

Available in 3 sizes

22, 27 and 32 tons

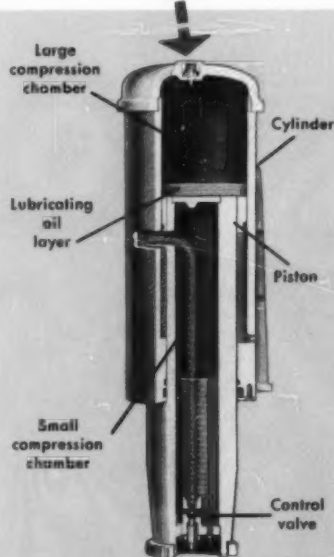
290, 335 and 375 hp

1 HYDRAIR smooths rough haul roads

On LW Haulpak, you get a sturdy, simple air-hydraulic suspension system that eliminates the costly, time-wasting maintenance and repair of springs. Four Hydrair units cushion against loading and travel shock... compensate *automatically* for off-center loading and keep the load riding level over humps and holes.

Other Hydrair benefits:

Located high out of dust, dirt, and moisture, Hydrair cylinders permit higher ground clearance (23") and sharper turning (Haulpak makes 180° turn in area only 44'6" wide). The elimination of springs and conventional front axle also reduces non-profitable dead weight.



How this exclusive suspension system works

Basically, Hydrair operates like this: The upper compression chamber above the piston supports the load on a cushion of nitrogen gas and the lower compression chamber acts as a rebound chamber to snub the return or downward movement of the piston. The maximum stroke of the piston is 14 inches in the two front suspension units and as much as 7 to 9 inches in the two rear Hydrair units.

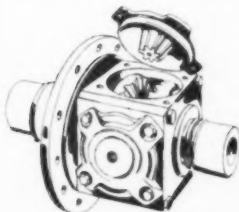
Conventional leaf springs have an "action space" of less than 4 inches, so it is easy to judge the tremendous improvement Hydrair represents as far as tire and vehicle life and operator comfort are concerned. Hydrair absorbs and cushions virtually all loading and travel shock, keeping this brutal punishment away from the tires, structure, and operator. Hydrair relieves the pounding on the road surface that creates "washboards".

..yours only in Haulpak

2 POWER-TRANSFER DIFFERENTIAL pulls load through soft footing

This same exclusive LW differential has boosted production and cut costs for thousands of LW Tournapull® owners for more than 14 years . . . and now, *for the first time*, it is available on a truck. The power-transfer

differential *automatically* puts power on the wheel with best traction, so you can haul through soft, slippery spots that bog down conventional haulers. The differential action also reduces wheelspin and tire wear.



The LW Haulpak differential works *automatically* at all times, is as simple in construction and as trouble-free as an ordinary differential. When one wheel tends to spin, idler pinions are automatically forced outward against friction surfaces. This slows the

slipping wheel, and transfers up to 4 times its tractive effort to wheel on firmer footing. Neither wheel will spin independently until the 4-to-1 ratio is exceeded.

HAULPAK saves you money many other ways:

LESS MAINTENANCE (entire lube-check, needed only at 500-hr intervals, consists of just 3 easy-to-reach grease fittings). **POWER-MISER FAN** (cools with 20 to 25 less hp drain). **FOUR SEPARATE BRAKING SYSTEMS** (for fast stops with complete safety). **POSITIVE POWER STEER** (for faster turning, easier handling). **SIMPLE SIX-GEAR FINAL DRIVE** (compared to 12 or more usually standard). **BIG, ROOMY CAB.**

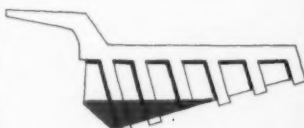


3 DEEP V-BODY gives you bonus tonnage within short wheelbase

Haulpak's exclusive deep V-body allows you to haul extra tons of material within a short wheelbase. Loaded material quickly fills all corners for big, low-void payloads. Deep "V" also provides a low center of gravity . . . gives Haulpak better stability on turns for high-speed hauling no matter how rugged the road.

In addition, the Haulpak V-body is exceptionally strong. It is constructed of high-tensile-strength steel . . . nearly 3 times stronger than steel commonly used in trucks, yet it weighs $\frac{1}{3}$ less. Result: *You haul up to 30% more payload than Haulpak's weight.*

Bonus yardage in every Haulpak load rides in the exclusive V-shaped body. Low loading height (10'1") and large top opening (14'5" x 11") makes it easy for shovel operators to load Haulpak fast, without spillage. Heavy rubber pads provide 100% cushioning of the body against loading and travel shock.



HAULPAK LW 80...

offers new low in hauling costs,
80 tons, 100 yd capacity... speeds to 40 mph

Proved in strip mine operations, the 450-hp LW 80 hauls materials at lowest-cost-per-ton. Constructed of light, super-strong steels, Haulpak hauls more than 2 times its weight in payload! It is easier to handle and maneuver than 50-ton units of conventional design. Has many other profitable advantages. Ask for complete information.



This 80-ton HAULPAK performs at the Midland Electric Coal Company mine near Farmington, Illinois.

BIGGER PROFITS for you in well maintained haul roads



You can count on fast, low-cost haul-road maintenance when you use powerful heavy-duty LW graders. That's because LW graders work at higher speeds, complete jobs faster. Use them to build and maintain haul roads, level stockpiles and fills, improve drainage. LW graders last longer because of their 100% anti-friction drive and rugged one-piece main-frame. And you'll profit by the big 63-inch blade circle... the quick, easy moldboard tilt adjustment... rubber engine mounts... and full-sweep visibility. Seven models, 67 to 190 horsepower.

See color film "Revolution on Wheels"

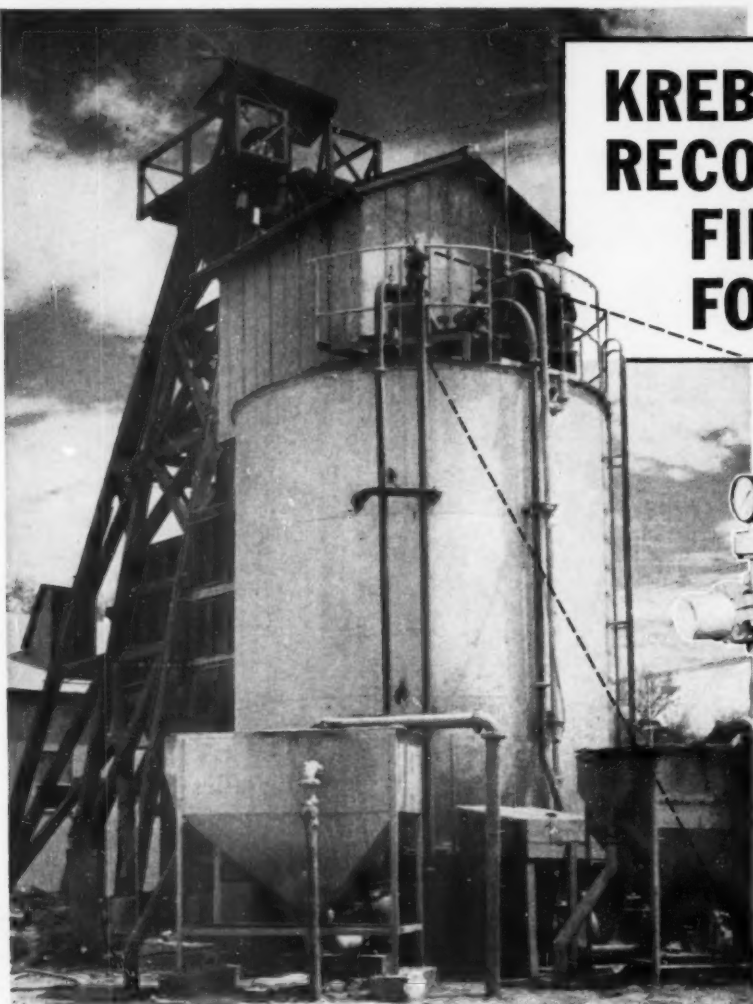
In this 15-minute film you will see Haulpaks at work on highway construction, in copper and iron mines, and in rock quarries. You'll see why and how Haulpak moves more tonnage at big savings. Your LW Distributor will be happy to show you this film, "Revolution on Wheels".

Get complete facts on LeTourneau-Westinghouse equipment from your LW Distributor

Your nearby LW Distributor is ready, willing, and completely able to help you solve your hauling problems. He also handles LeTourneau-Westinghouse earthmoving equipment—Tournapulls, rubber-tired tractors, Rear-Dumps—and other lines of proven production tools. He is in a position to give you honest appraisal of trade-in equipment, and can assist you in obtaining helpful financing when it is needed.

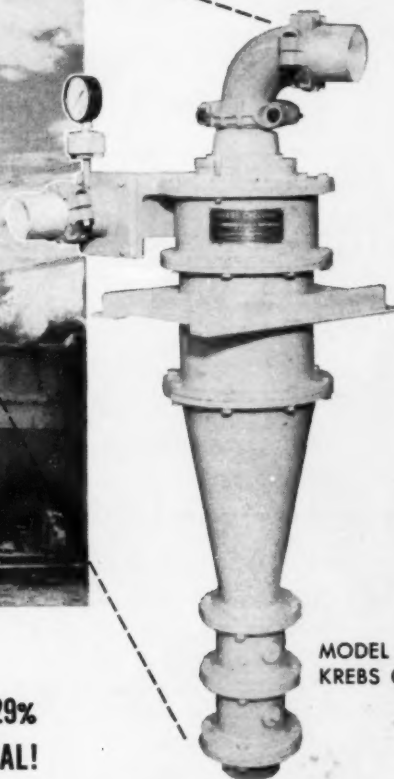
See your Distributor, too, for dependable repair service and LW factory parts. You will be pleased with his prompt and efficient attention to your needs. Ask him to check your parts stock, and help arrange a schedule so his service department and yours can work together with greatest efficiency. You'll find your LW Distributor a good man to know. See him soon.





Installation at Banner Mining Company Copper Operation near Tucson, Arizona

KREBS CYCLONES RECOVER 80% OF FINE TAILINGS FOR MINE FILL



MODEL D10B
KREBS CYCLONE

EXCEPTIONAL WEIGHT RECOVERY FROM TAILINGS OF 29% SOLIDS CONTAINING 47% MINUS 325 MESH MATERIAL!

GOOD PERCOLATION AND FAST SET! Fresh pours drilled from after 4 hours...ore blasted down on fresh fill the following shift.

Results for the above application were closely predicted in advance from test work performed in our Pilot Plant. Units were recommended that would meet the objectives of high weight recovery from a fine product in an area where water was scarce.

There are Krebs Cyclones of the correct size and design available for your specific objectives.

PERFORMANCE CHART OF 2 KREBS D10B
CYCLONES AT BANNER MINING COMPANY

	FEED	OVERFLOW	UNDERFLOW
% Solids	29.0	9.0	74.0
SIZING--	FEED	OVERFLOW	UNDERFLOW
% +100	4.9		6.2
+150	10.2		13.0
+200	12.7		16.2
+325	25.2		32.2
-325	47.0	100.0	32.4

EQUIPMENT ENGINEERS INC.

737 LOMA VERDE AVENUE • PALO ALTO, CALIFORNIA

SPECIALIZING EXCLUSIVELY IN CYCLONE TECHNIQUES

JANUARY 1960





At the Maumee Collieries in Indiana...

ANACONDA SHOVEL CABLE HAS A RECORD: 10 YEARS ON THE ROCK PILE!

Anaconda's SH-D Cable gives many years of dependable service in spite of heat, moisture, kinks, rocks and runovers!

How many shovel cable hazards can you count in this picture from the Maumee Collieries? Rocks... moisture... kinks... danger of runovers—they're all there. Yet the first installation of Anaconda's rugged SH-D Shovel Cable has resisted them all—for 10 long years!

It's proof again of the way Anaconda's in-the-field experience with Shovel Cable pays off in a superior cable for you. The important knowledge gained from use and testing of SH-D Cable *on the job* in our own mines goes into the design and manufacture of Anaconda Shovel Cable.

For example, the insulation is Anaconda Butyl (AB). Nothing can beat it for withstanding ozone, heat and moisture. Patented rubber cores cushion the ground wires and help prevent breaks from kinks and runovers. SH-D has a neoprene jacket that is exceptionally tough and abrasion-resistant. And every design, every component has been job-tested—your assurance of superior quality and performance.

Call on the Man from Anaconda with your cable problems. Or see your local Anaconda distributor. For new descriptive Bulletin DM-5818, "Anaconda Security-flex Portable Cables for the Mining Industry," write: Anaconda Wire & Cable Co., 25 Broadway, New York 4, New York.

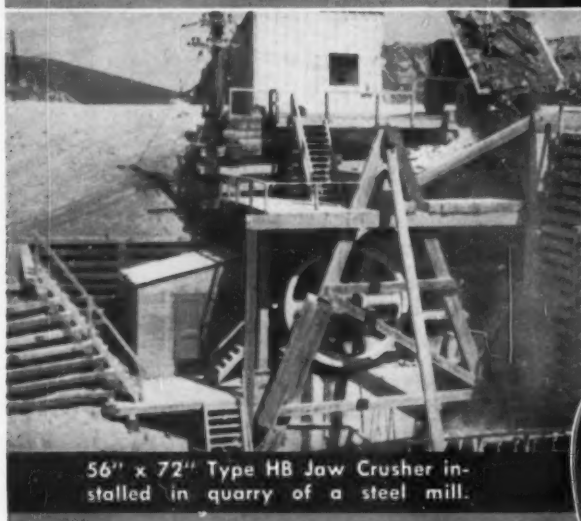
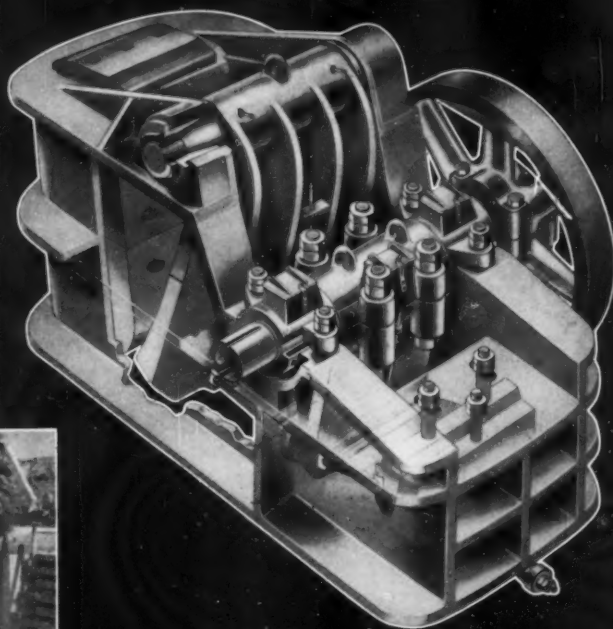
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◀ For a decade, the Anaconda SH-D Shovel Cable you see here has been giving dependable service for the Maumee Collieries, Jasonville, Indiana. Its many superior design features enable it to resist on-the-job hazards that would knock out ordinary shovel cables.

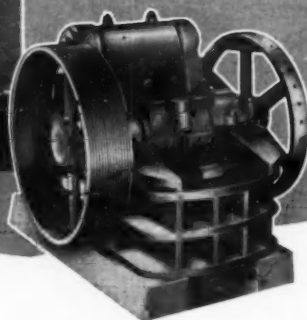
ASK THE MAN FROM
ANACONDA®
FOR **SHOVEL CABLE**

Traylor-made H & HB Jaw Crushers

Cutaway view below shows the advanced design of Traylor type HB Jaw Crusher.



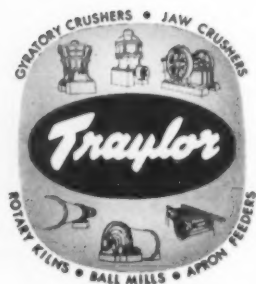
56" x 72" Type HB Jaw Crusher installed in quarry of a steel mill.



Visit us at Booth No. 56 at the
CRUSHED STONE SHOW—Feb. 22 thru 24
Conrad Hilton, Chicago.

One of the many important features of the Traylor HB Jaw Crusher is the Traylor developed curved jaw plates employing the principal of the famous curved setting which have proved so successful in Traylor crushing machinery. The forged

steel swing jaw shaft and the patented swing shaft suspension are two more of the features built into Traylor Jaw Crushers. For more information, write for Traylor Bulletin No. 5105.



ENGINEERING AND MANUFACTURING division of FULLER COMPANY

Sales Office: 1502 MILL ST., ALLENTOWN, PA.

Sales Offices: New York—Chicago—San Francisco

Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.



MINING WORLD



Work-ability of "EUC" Crawlers Steps Up Production on Tough Stripping Jobs

Euclid's modern crawlers—the 211 net h.p. Model C-6 and the Twin-Power Model TC-12 with 425 total net h.p.—have set new standards of tractor production in mine and quarry work. With performance proved Torqmatic Drive, both of these crawlers have excellent maneuverability and fast response that cuts work cycle time. They're engineered for easy service accessibility that results in less downtime and lost production.

Have your dealer give you all the facts on these "Euc" tractors...he'll show you the features that pay off in better production on every stripping job, whether it's heavy dozing or ripping work, push loading big scrapers, or moving coal, ore and other materials.



EUCLID EQUIPMENT

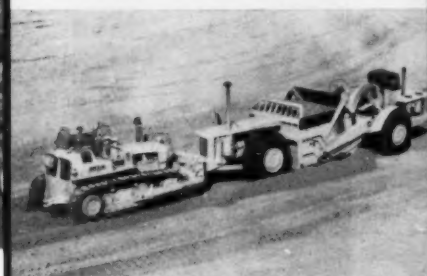
FOR MOVING EARTH, ROCK, COAL AND ORE

EUCLID Division of General Motors
Cleveland 17, Ohio

Plants at Cleveland and Hudson, Ohio,
and Lanarkshire, Scotland.



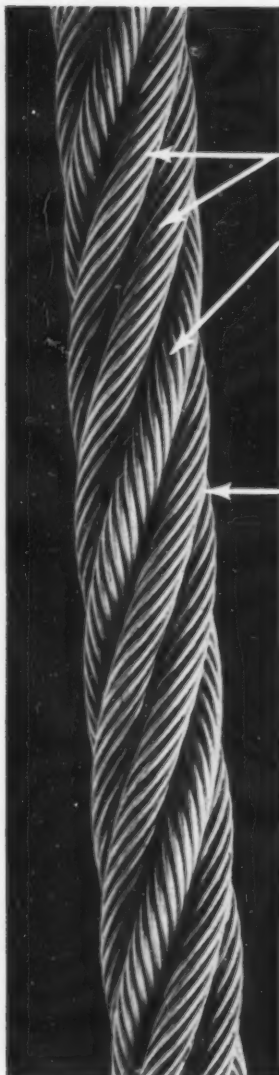
At a coal stripping operation in Pennsylvania, this TC-12 removes overburden at a rate of 400 to 500 yds. per hour. It is equipped with 16' blade...works two 8 hr. shifts a day.



Euclid Twin-Power teams — TC-12 Crawlers and TS-24 Scrapers — move over a million yds. a month at this Wyoming open pit uranium operation.



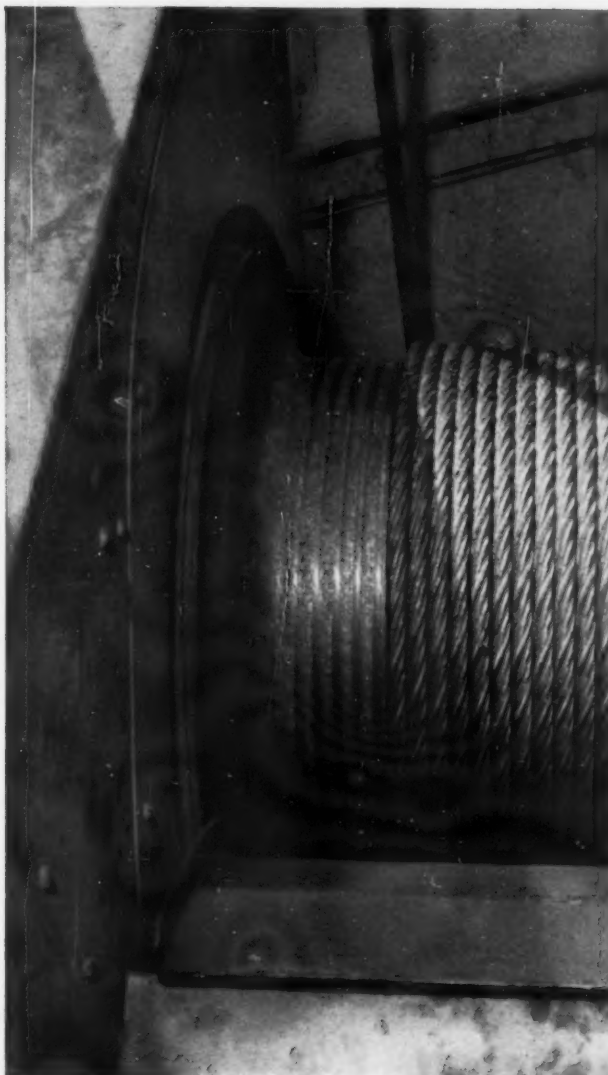
Model C-6 crawler back-filling overburden in the pit...full-power shift, good visibility and fast response make this "Euc" a high production machine for mine and quarry work.



Herringbone's two pairs of Lang lay strands and one pair of regular lay strands provide the ideal combination of maximum flexibility with good stability.

Finer wires inside contribute to Herringbone's excellent drum-winding characteristic.

Heavier outside wires in each strand have greater resistance to abrasion.



**"... we
would
never
hesitate
to recommend it"**

GRAY & FEAR, CONTRACTORS

This company continues: "We have been using your Roebling Herringbone* for about one year. We find it is one of the best ropes we have ever used, outlasting previous ropes three to one. It is good that such a reliable rope is available."

This is a direct field quote on the most remarkable development in wire rope in years...a new concept in wire rope design. Roebling Herringbone is the regular lay and Lang lay wire rope—two-ropes-in-one rope—combining the best features of both.

Herringbone delivers extra flexibil-

ity, extra abrasion resistance, unusual structural stability, extra resistance to shock, easy operation over sheaves and drums and smooth spooling properties.

We recommend Herringbone without reservation for general hoisting and the entire range of heavy-duty equipment. Your Roebling Distributor or Roebling's Wire Rope Division, Trenton 2, New Jersey, will give the full and fabulous details.

*Reg. App. For

ROEBLING

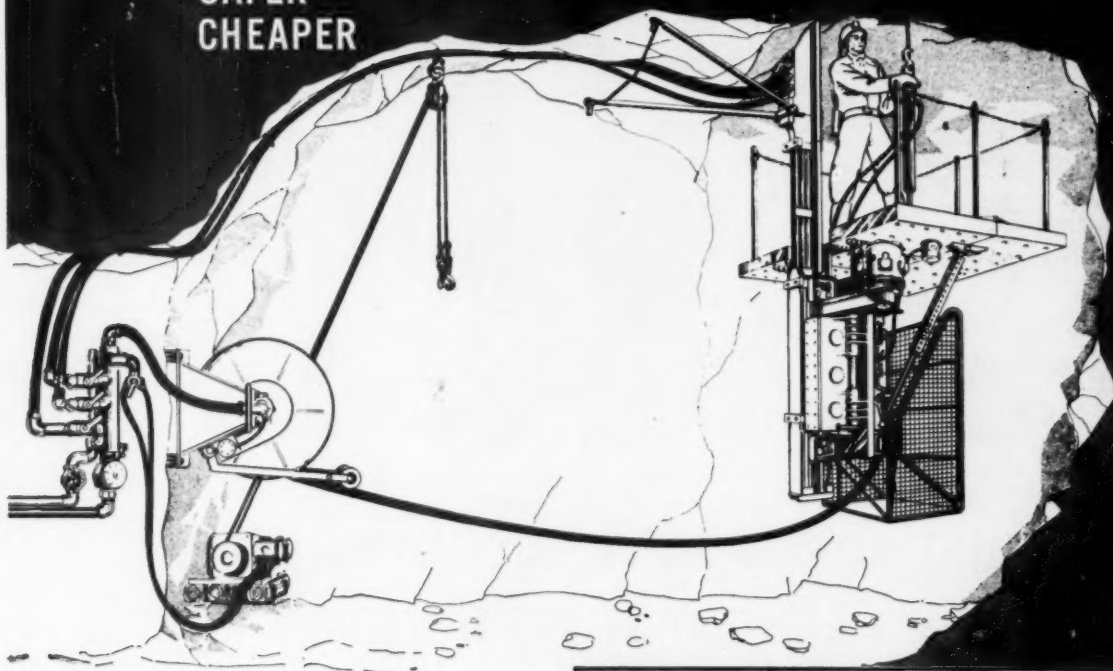
Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation



NEW ALIMAK Raise-Climber*

Provides fully self-contained elevating system
for driving raises from 40 ft. up to 1200 ft. or more

**FASTER
SAFER
CHEAPER**



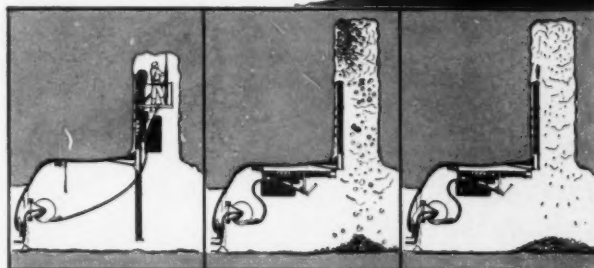
This major advance in driving raises is not only faster in all types of rock, but eliminates much of the heaviest and most dangerous work associated with existing methods. The *Alimak Raise Climber* consists of an easily portable all steel elevator which quickly climbs a rack equipped guide rail. The operator is raised to the working face where he drills for charges. After descending, the platform is folded back for blasting, cleaning out and ventilating. Operator then ascends and fits another 3 ft. or 6 ft. rail section for the next drill-blast cycle.

One man can carry out all operations with fingertip control of four services housed in rail section — air, water, electricity and telephone.

Thoroughly tested and proved in over 100 world-wide mining operations, the *Alimak Raise Climber* holds the *Mining World/World Mining Magazine* 1959 Blue Ribbon Mining Award.

Complete sales and service representation available throughout the United States. Write for full details, today.

*Patent Pending



Climber moves up guide rail, fastened to rock by expansion bolts. Permits full range of operations at face of raise.

Bottom guide rails and Climber swing back under cover of the roof for blasting. Raise-Climber method eliminates staging and restaging.

High-pressure water and air provide quick clean-out of gases and dust; assures faster drill-blast cycle in verticle or diagonal raises.

A Product of Swedish Engineering



ALIMAK

RAISE-CLIMBER ELEVATING SYSTEM

Alimak Corporation

306 Avila St., San Francisco 23, California
A Subsidiary of Alimak-Verken AB
Skelleftea, Sweden



Lima Type 1800 5-yd. shovel—one of five Limas owned by Mittry Construction, Los Angeles. Shown excavating at Abiquiu earth fill dam project, Shama River, N. Mex.

Lima announces new 5-yd. shovel 140-ton special crane

TYPE 1800

- Standard 5-yd. shovel with 35-ft. boom, 26-ft., 10-in. dipper handle; 7 or 8-yd. dipper for coal handling
- Converts to 112-ton crane
- Variable capacity dragline

TYPE 1800SC

- 140-ton special crane with 21-ft.-wide truck base for stability with big lifts
- Converts to variable capacity dragline

These new Limas are designed to permit knock down for job to job transportation. Side assemblies come off as a unit—including belts, crawler chains and sprockets. Counterweights are removable. Backhitch-telescopic-type gantry folds down to 17-ft., 5-in. overhead clearance.

LOW MAINTENANCE REQUIREMENTS—You get more for your money when you buy a LIMA. They last longer, perform better, and require less maintenance. Lima offers you

all of these important features in a single machine—

- Air control
- Torque converter drive
- Anti-friction bearings at all important bearing points
- Large diameter clutches and brakes
- Two-shoe-type swing-propel clutches
- Combination rope-chain crowd
- Single-inside-type dipper handle, 15" square
- Extra Long crane booms and special jibs available
- Convertible to crane or dragline
- 9' - 10 1/4" dia. roller path
- Six cone rollers, six hook rollers
- Standard or long, wide crawlers
- Diesel or electric power
- Knock down for highway transportation
- Independent two-drum boom hoist
- Independent propel
- Auxiliary third drum
- Power load lowering

FACTS AND FIGURES on the new 1800 and 1800SC are yours for the asking. See your nearby Lima distributor today or write to Baldwin-Lima-Hamilton Corporation, Construction Equipment Division, Lima, Ohio.

DISTRIBUTORS IN PRINCIPAL CITIES OF THE WORLD

Cable Address: LIMASHOVEL, Lima, Ohio, U.S.A.

LIMA Construction Equipment Division, Lima, Ohio
BALDWIN · LIMA · HAMILTON

Shovels • Cranes • Draglines • Pullshovels • Roadpackers • Crushing, Screening and Washing Equipment





Drilling Outlines Major Canadian Tungsten Deposit

Canada Tungsten Mining Corporation has been organized to develop what appears to be a major tungsten discovery in the Northwest Territories of Canada. A \$5,000,000 program is planned to bring the property into production by the end of 1961 at a rate of 300 tons per day. At present, survey work is underway for a winter road, and a preliminary study is being made of a potential power site nearby. Metallurgical test work is also being undertaken.

The 83-claim property is located in the McKenzie Mountain Range, 150 miles north of Watson Lake on the Alaska Highway, and a few miles east of the Yukon-NWT border (see map). Limited drilling has indicated 1,166,351 tons of open-pit ore averaging

about 2.18 per cent WO_3 . The orebody appears to be located in the center of the claims, with numerous showings both north and south. It is a disseminated scheelite in a flat-lying bed of massive pyrrhotite in a limestone formation.

Backers of the new venture are Leitch Gold Mines, Highland-Bell Ltd., Area Mines, Dome Mines, and Ventures Ltd., each holding a 14.52 per cent interest, while Lake Expanse Mines as 4.85 per cent. The balance is held by individuals.

The tungsten discovery was actually made by the McKenzie Syndicate, formed by Karl J. Springer, with financial assistance from the firms above. The Syndicate will remain active in its exploration work.



DeBeers Develops Synthetic Industrial Diamonds

The DeBeers diamond group has entered the field of synthetic diamonds as a potential competitor of General Electric Company. Synthetic diamond grit suitable for use in resinoid bonded grinding wheels has been produced in the Adamant Laboratories in Johannesburg, South Africa.

GE scientists first produced diamonds from carbon in February 1955, and have been selling in commercial quantities since October 1957. While output has never been disclosed, an estimate of 1958 production was about 750,000 carats. In contrast, DeBeers had shipped about 7,000,000 carats of diamond abrasives or "bort" to the U.S. that year.

X-ray diagrams of a natural diamond and a DeBeers synthetic dia-

mond are shown below. The natural diamond is at the bottom of the diagram, and the synthetic above. Both are single crystals and were photographed using a special camera with a diameter of 57.5 millimeters. The X-ray diffraction spots are seen to be arranged in circular arcs. The arcs on the higher diagram are identical with those on the lower; scientifically, this is considered conclusive proof that DeBeers' new product is genuine synthetic diamond. These photographs or diagrams are likened to fingerprints which exclude all doubt as to the exact nature of the product.

According to H. F. Oppenheimer, board chairman of DeBeers Consolidated Mines Ltd., their synthetics are the same type as the ones made by GE. He added, however, that the

company did not have sufficient details of the GE process to determine whether the two manufacturing processes are the same.

DeBeers started research on this project in 1955, established the lab in 1956, and commissioned its pressure chamber in 1957. In September 1958, it yielded its first synthetic diamond, 0.4 mm by 0.25 mm in size, and made up of 6 equal-sized cemented particles. Following modifications and improvements in the pressure-heat chamber to give consistent results and to maintain critical conditions for synthesis, and after numerous variations in type of starting material to give better yield values, the continuous production of synthetic diamond was finally achieved on September 16, 1959.



Motorized Wheel

Provides a New Tool for Solution of Haulage

The wheel with a built-in motor that attaches to a truck frame and is driven by simple gear arrangement continues to attract attention in the mining industry because it opens attractive possibilities for high-speed haulage against steep grades.

Already The Anaconda Company has received delivery of an electric truck equipped with four 400-horsepower wheels which will be put into operation at the Berkeley open pit in Butte. Though the Anaconda truck contains a small Diesel-generator set, it will normally be operated from a trolley system (see MINING WORLD, August 1959, page 31).

Another company on the Mesabi Iron Range has ordered a truck equipped with four General Electric Company motorized wheels. This truck will be powered by a Diesel-generator set located on the hauler (see MINING WORLD, December 1959, page 51).

The above two examples serve to pinpoint the two methods for supply-

ing dc power to the motors within the rim of the wheels. Both of the above trucks will feature four-wheel drive, but vehicles can be built for two-wheel drive where maximum performance against grade is not a critical feature of the operation.

Today, trucks containing motorized wheels stand ready to challenge. Diesel-driven trucks which have maintained almost sole possession of ore transport duties over grades between four and 20 percent. The Diesel-driven trucks were dominant in this field largely because they were equipped with lightweight mechanical transmissions or torque converters. Solution of weight problems for electric wheel drive has whittled down this advantage.

In applying trucks to haulage problems, operators must balance three variables to achieve low cost. They are capacity, maneuverability and performance.

With increased labor rates and shrinking profit margins, operators

have turned to progressively larger vehicles with each round of equipment replacement. Growth in truck size has not been balanced, however, by corresponding progress in the areas of performance and maneuverability.

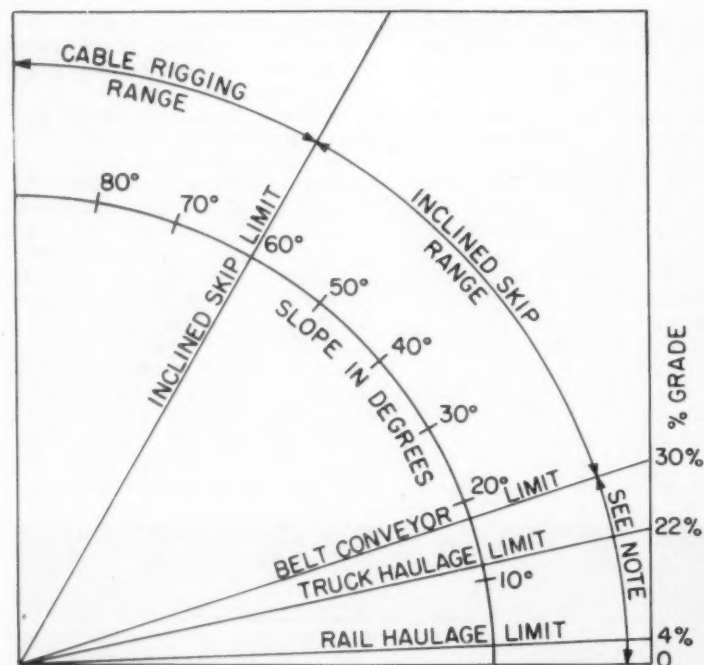
Today, the user may elect to have any two of the above variables, but he must sacrifice the third. For instance, he can obtain capacity and performance in any number of rigid frame trucks, but the lack of maneuverability in the large-size, front-wheel, steering units limits application in open-pit mines.

Capacity and maneuverability can be obtained by using "rocker" or fifth-wheel steer units. While these latter can turn in less than their own length, they are inefficient under really adverse grade situations.

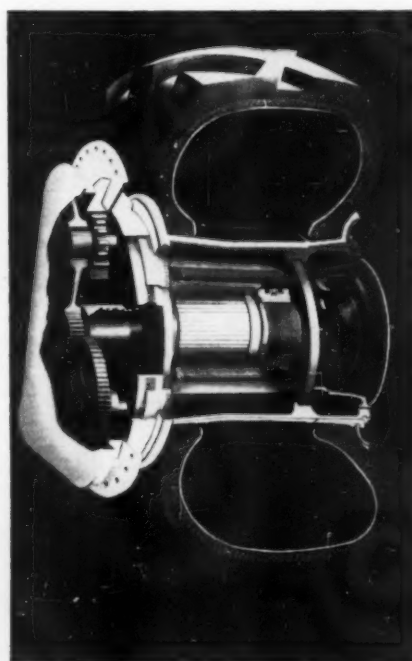
The General Electric motorized wheel raises the sights on rubber-tire haulage units to new horizons. For example, this new concept can provide:

► A four-wheel truck up to 125 tons

On 4 to 22% grades Diesel-driven trucks are supreme . . . But electric wheel . . .



ECONOMIC LIMITS of five haulage methods show that electric drive is accepted for grades below four and above 20%; where overlap occurs local conditions determine equipment choice.



G. E. ELECTRIC WHEEL solved a weight distribution problem and made the motor in the wheel a load-carrying member of the truck.

Problems in Open Pits and at Underground Trackless Mines

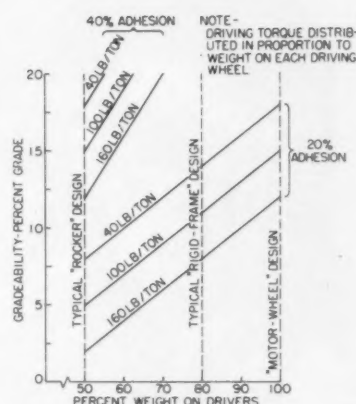
- gross weight and with a payload capacity of 60 to 70 tons.
- ▶ A nominal capability of 1,500 horsepower total at the wheel rims.
- ▶ Entire vehicle weight on drivers, permitting operation on grades up to 15 percent at 20 percent adhesion and 100 pounds per ton rolling resistance (see chart on following page).
- ▶ The ability to negotiate long, steep grades where tractive effort requirements are in the 40,000- to 50,000-pound range.

The above features represent "locomotive" performance. They are such a long step forward that the haulage application that can make use of this drive is in a class by itself.

Briefly, the gear box and the motor frame comprise an integral unit which carries the large-diameter wheel bearings and rim. The motor is a locomotive, traction-type, d-c series field machine. The armature shaft is supported by sealed, grease-lubricated bearings and is splined to drive a high-speed

sun pinion shaft. The sun pinion is supported only by the spline and is free to move in order to divide the load equally among three fixed high-speed planet gears. Low-speed planet pinions, integral with the planet gear shafts, engage the internal ring gear for the final drive reduction. Total gear reduction is 39.8:1, providing 35 mile-per-hour top vehicle speed with a 44.5-45 tire. The rolling diameter of the tire is 102.8 inches. One tire manufacturer recently added this tire to its standard line of tubeless off-highway vehicle tires and is offering it with a load capacity of 62,900 pounds at 35 pounds per square inch pressure of the 32-ply rating.

A high-speed disc brake, such as is used on heavy aircraft, is mounted on the outboard end of the armature shaft and is used for parking, low-speed service, and emergency applications. Normal service braking is obtained electrically. The traction motors are used as generators to dissipate the braking energy in the form of heat in



GRADE ABILITY of haulers is effected by percent weight on drivers, percent adhesion and rolling resistance.

Mr. Price is with the industrial engineering section and Mr. Volpe with the Locomotive and Car Equipment Department, General Electric Company.

Now opens the possibility of hauling 60-ton loads up 15% grades at 12 to 13 mph



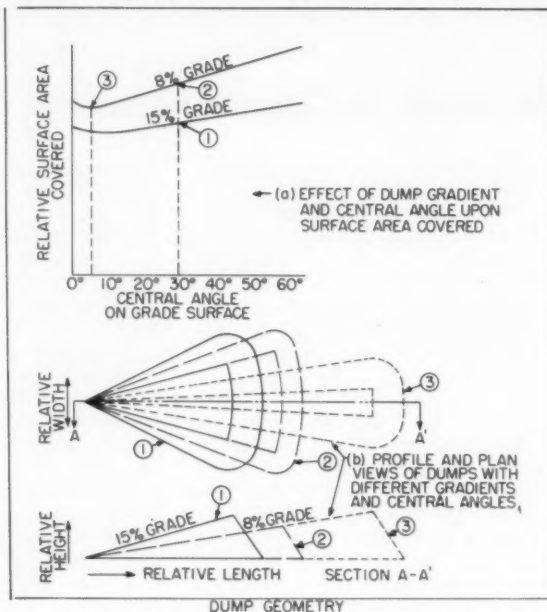
ELECTRIC WHEEL DEVELOPMENT was slowed by excessive weight of rotating machines compared to mechanical or hydraulic transmissions used with Diesel trucks. These advan-

tages have been cited for electric wheel drive: maximum horsepower utilization with full power plant horsepower to all wheels; less maintenance; longer tire life; simple operation.

Illustrations show that electric haulage may provide greater speed,



TROLLEY TRUCK was converted from a standard Diesel model and can reportedly haul up to 50 percent more rock from an underground limestone mine in about half the time.



WASTE DUMP GEOMETRY shows that less surface area is covered and the haul shortened by increasing the gradient on which dump is built; above example assumes level terrain.

air-cooled resistors. This type of braking system, in use for years on railway locomotives, is called dynamic (more properly, rheostatic) braking.

The Diesel, direct-coupled generator type of truck has been tested for over two years. It offers a 50-ton capacity and has an estimated selling price of \$125,000. This compares with a current market price of \$105,000 for a 50-ton capacity, twin-engine, rear-dump truck with torque converter and three-speed transmission. Almost \$12,000 of the difference is accounted for by the more expensive, larger, single tires, and this difference should decrease as volume production of the large tires is attained. In return, however, users may expect to realize longer operating life from the large single tire than they obtain with smaller dual tires of comparable total capacity.

Conservative performance studies have shown that the Diesel-electric vehicle can move over 170 tons per hour on a one-mile haul over 8 percent grade. This compares with 150 tons theoretically possible under ideal conditions with the Diesel-torque converter truck. Production, of course, varies with roadway conditions, shovel capacity, and maneuvering required.

The total operating cost on a per-hour basis would be about the same for both vehicles, but the real yardstick of economic comparison is the cost per ton of material moved. Calculations on the theoretical one-mile

haul outlined above indicate a saving of the order of about 1.4 cents per ton for average conditions.

The limiting parameter on Diesel-electric drive performance is the capability of the engine. The drive is capable of delivering 380 rim-horsepower per wheel. To utilize completely the design capability of this drive, trolley electrification becomes attractive. Straight-electric vehicles receive power from a two-wire, nominal 600-volt d-c overhead contact system in much the same manner as trackless trolley coaches operate.

Recently, a Southern California limestone company undertook an electrification program for trackless units that hauled output from room-and-pillar stopes to the surface. This program was undertaken before the G.E. motorized wheel became available. After considering various known haulage units, standard Kenworth model 802, end-dump, off-highway trucks were equipped with General Electric, 350-horsepower, d-c traction motors. The motor replaced a 300-horsepower Diesel engine with which this truck model is normally equipped. The traction motor turns the propeller shaft of an otherwise conventional drive train on the truck. Power is taken from a trolley system and the trucks are fitted with cable reels and reel motors for maneuvering at stope faces.

When descending a grade, braking on the converted trucks is accomplished electrically. Trolley haulage

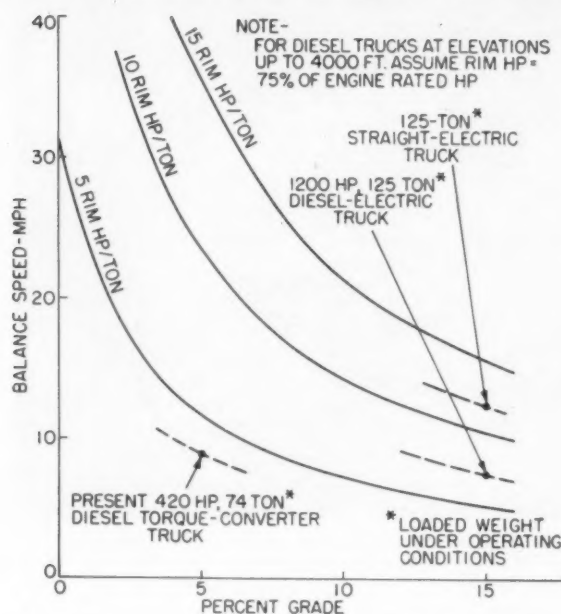
provided a practical and economical alternative to the ventilation problem which the use of Diesel-powered trucks would have introduced.

The truck electrification program attracted widespread attention because of the ability of converted trucks to outperform conventional Diesel trucks. Maintenance costs on the trolley-trucks proved to be attractively low. In discussing this application, a mine official recently reported:

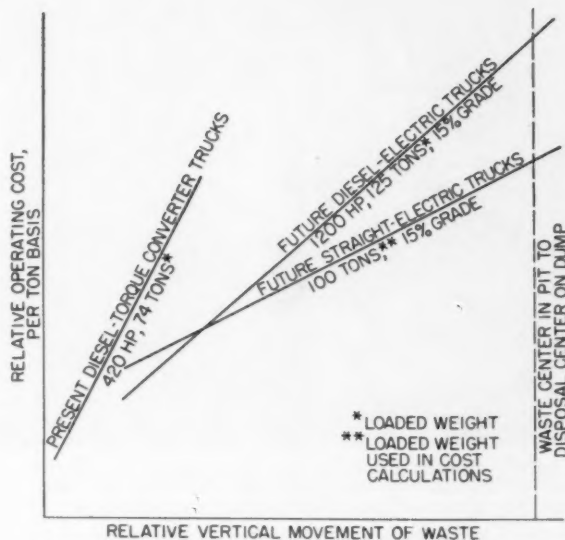
The first cost of the electric truck is considerably higher than that of the Diesel truck. Because of the increased production on the long (4400-foot) haul, however, the direct operating labor cost is less. Certain unforeseen benefits have appeared by switching to electric trucks for our main haulage. Tire wear and ability to maintain traction on muddy roads are the main advantages in this group. Lower maintenance costs resulted because there are no brake, gear, or clutch problems.

One of the open-pit operations under study represents a very early stage in the development of an extensive and deep body of low-grade ore. The depth of the ore body and the ultimate size of the waste dump for overburden indicated that haulage units would be working on several adverse grades. The mining company, on the basis of practical considerations involved in moving waste and building a waste dump, defined the problem as being in the truck-haulage range and thus fixed the scope of the

better grade performance, more capacity and lower operating costs



RELATIVE SPEED of Diesel trucks in open pit described in text is less than the higher anticipated speed expected from proposed Diesel-electric or all-electric truck at same mine.



COST COMPARISON of three methods of powering haulage vehicles highlights efficiency of all-electric truck on long, steep grades due to reduced maintenance and greater speed.

study. Haulage at the mine is further complicated by the fact that the waste dump must be built on rising terrain.

Diesel-torque converter trucks, acquired during initial development of the pit, are limited to operation on a 5 percent gradient for lengthy hauls.

The use of four motorized wheels on a 60- to 70-ton-capacity truck with all weight on driving wheels promises reliable operation on a 15 percent gradient for relatively long hauls in this open-pit mine. Main haulageways are well maintained, cinders are spread rapidly in the event of roadway icing, and fuel consumption records indicate favorable conditions of rolling resistance. To meet the needs of the application, the vehicle will have a loaded weight of about 125 tons and will be either:

1. A diesel-electric vehicle with twin 600-horsepower engines, capable of delivering about 900 horsepower to the wheel rims at sea level. Speed will be about 7.5 miles per hour ascending a 15 percent grade with full load and with 60 pounds per ton rolling resistance.
2. A straight-electric vehicle operating from a nominal 600-volt contact system. Speed will be about 12.5 miles per hour ascending a 15 percent grade at any altitude, based upon 60 pounds per ton rolling resistance. This condition closely matched the motorized wheel

drive capability of 380 rim-horsepower per wheel.

Either truck would use dynamic (rheostatic) braking, and would be equipped with air brakes capable of stopping the truck under emergency conditions. The straight-electric truck would be provided with an auxiliary 350-horsepower Diesel generator set for spotting the truck at shovels and at the dump while away from the trolley lines.

Either truck would represent a substantial advance in horsepower-per-ton-ratio for large off-highway vehicles, and the straight-electric vehicle will represent a breakthrough in total horsepower available at the wheels of such vehicles.

The proposed electrical haulage layout, including the contact system, feeders, and rectifier substations, represents a greater total investment than the Diesel-electric haulage system. Where anticipated long-term mining of a large ore body and the building of a large waste dump are involved, these studies indicate that an attractive return on the additional investment in the straight-electric system may be realized.

The relative costs of moving waste by present Diesel-torque converter trucks, and anticipated costs with future Diesel-electric and straight-electric trucks are compared by the diagram above. The advantage of the Diesel-electric truck over the smaller and lower horsepower-per-ton Diesel-

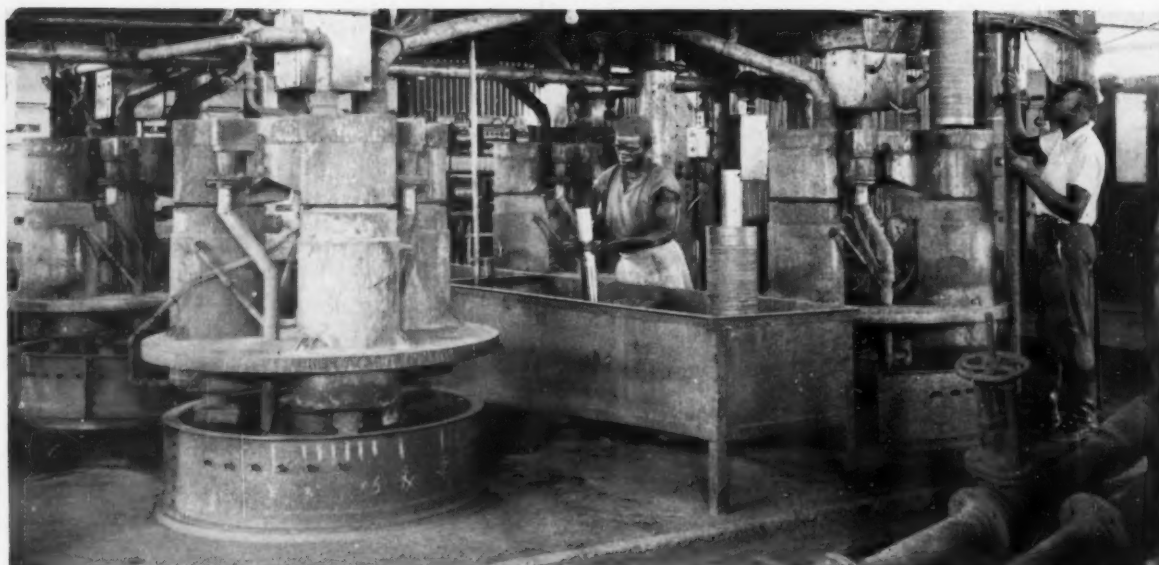
torque converter truck is principally the result of savings anticipated in labor costs and in drive-train and brake maintenance. The straight-electric system shows an additional saving over Diesel-electric trucks after a cross-over value of vertical life is reached. This results principally from savings in engine repair costs, energy costs, and further savings in labor because of the high performance of the straight-electric vehicle. Before the cross-over point is reached, full electrification is less advantageous than Diesel-electric operation largely because of the cost of relocating the portable sections of the 600-volt contact system on benches and dumps as mining progresses.

Full-scale application of straight-electric vehicles capable of loading the motorized wheel drive to its maximum tractive effort, horsepower, and static load capabilities may be anticipated after successful operation on a trial basis has been achieved. Although each element of the electrification system has been the object of intensive study and development, the co-ordinated combination of these elements creates a system of unusual capabilities which the industry will understandably want to see in order to believe.

END

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1. Electric Drive for Off-Highway Vehicles, H. J. McLean, H. Vitt, SAE Preprint 92T.
2. Electric Truck Haulage at Crestmore, P. B. Nalle, Mining Engineering, April 1959.



FRANTZ FERRO FILTERS separate a germanium-rich concentrate from primary copper flotation concentrate at Kipushi mill. The germanium mineral, renierite, is magnetically recover-

able when it occurs in visible amounts in ore. Natives are removing inner filter grids and cleaning wood pulp from them. Filters at left are operating; cleaning underway at right.

Rare Germanium Mineral—Renierite

Recovered By Magnetic Upgrading

By L. Steygers

Union Minière du Haut Katanga recovers, by magnetic upgrading, a small portion of the germanium in a copper-germanium flotation concentrate from its Kipushi mine ore.

Germanium is present in renierite $[(Cu, Ge, Fe, Zn, Ga)_4(S, As)_4]$, a ferromagnetic mineral sometimes called "orange bornite." It has a similar chemical composition to germanite, but has a higher iron and lower germanium content—about 7.3 percent Ge at Kipushi.

Much of the renierite is extremely disseminated in the copper and zinc sulphides—chalcopyrite, bornite, and sphalerite—perhaps in solid solution to such an extent that it can be detected or recovered only by chemical methods. Separation of this renierite from the other sulphides by gravity, magnetic concentration, or flotation proved to be impossible.

In some locations in the Kipushi lode, however, renierite is visible as

a distinct mineral and can even in some instances be recovered by hand picking. Under this occurrence, the mineral can be recovered by a physical process—magnetic concentration. Tests showed that renierite floated very easily in the first cells of primary copper flotation and that part of it could be recovered by magnetic concentration. Table No. 1 shows the selective floatability of germanium in the copper flotation circuit.

In the Kipushi mill, most of the ores are treated by selective flotation to produce a copper concentrate and a zinc concentrate. The first step is to make a primary copper concentrate high in copper and low in zinc for direct copper smelting. This concentrate recovers the chalcopyrite, chalcocite, galena, part of the bornite, and also the renierite when ore being milled contains visible renierite.

Some germanium is present in both the zinc and secondary copper concentrates. The latter is added to the primary copper concentrate for smelting. From this, the residual germanium is partially recovered in smelter fumes; however, the most important portion is contained in the slag and will be recovered later, together with zinc, by

a fuming process.

Studies were made to recover the germanium in the primary copper concentrate. Tests with a Frantz Isodynamic magnetic separator were favorable so tests were next made using a No. 31 Frantz FerroFilter. Results showed that a certain concentration of germanium was possible in a small tonnage of copper-germanium concentrate.

A pilot plant with one type 461 FerroFilter (16 amperes-110 volts) was set up in the mill to ascertain the practical conditions necessary for such an operation. In October 1957 a full size plant using 12 type 461 Ferro Filters was commissioned.

The process is essentially discontinuous for each separate filter. It consists of the three successive steps outlined in Table No. II.

The outlined cycle was found to be the most suitable under prevailing conditions. The first step (90 seconds) is the active one; primary copper concentrate being fed to the filter, the magnetic concentrate being retained, and the remaining pulp sent back to the primary copper concentrate going to the smelter. The duration of this step is 2/3 of total cycle time. The

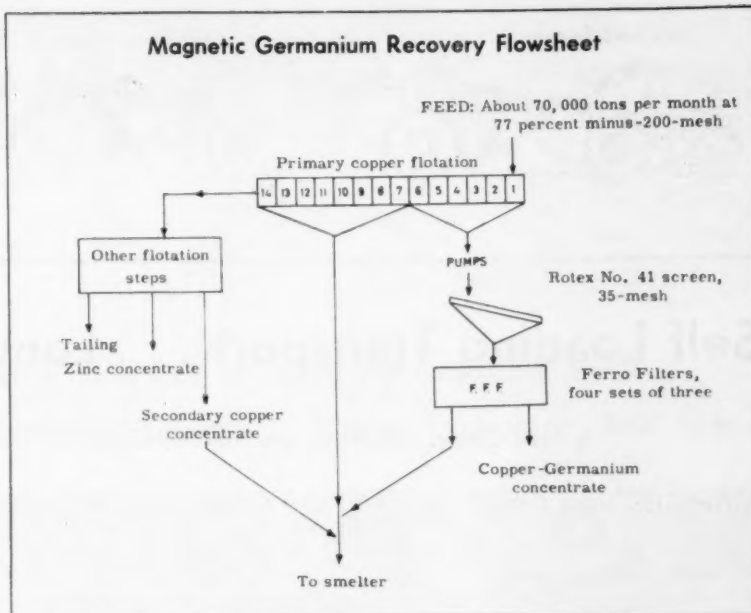
Mr. Steygers is consulting engineer for Union Minière du Haut Katanga, Elizabethville, Belgian Congo.

second step (15 seconds) is for cleaning, where the nonmagnetic or slightly magnetic particles retained between the germanium-rich particles are washed off with clear water. The third step (30 seconds) flushes the magnetic concentrate to the copper-germanium concentrate tank to clear the filter for the next cycle.

The 12 FerroFilters are arranged in four sets of three. In each set the filters are fixed to a disc rotating at one revolution in 135 seconds. A motionless triangular tub continuously distributes two volumes of pulp and one volume of clear water through separate launders suitably arranged to comply with the requirements of the cycle's different steps. The pulp, discharged from the three filters, flows into a circular tub located under the rotating disc and provided with radial partitions separating a sector of 80° for the copper-germanium concentrates (step 3) and another of 280° for the nonmagnetic pulp (steps 1 and 2). Other arrangements are possible, of course, more particularly those with fixed filters and moving distribution. Electric current is distributed by a rotating series of contacts, synchronized with the disc. The motor-generator set can deliver up to 200 amperes.

Some adjustments of the cycle steps are possible by changing the partitions of the discharge tub and modifying accordingly the current distribution, in order to alter the duration of the second and third steps. The cleaning period thus can be extended or shortened, according to requirements.

Three of the four sets of filters are normally in operation, while the fourth



is idle for cleaning the inner grids. One FerroFilter can handle up to 5.5 cubic meters (about 200 cubic feet) of pulp with a content of 1,350 grams of solids per liter per hour.

Feed to the filters is primary copper concentrate from the first cells of the several Denver flotation machines. For Kipushi ores, it has been uneconomical to treat a larger amount of copper concentrate by magnetic upgrading because the germanium content is too low. It is also unrecoverable in the FerroFilters because of its extreme dissemination in the copper minerals.

Flotation concentrate is screened on a Rotex screen ahead of the filters to

separate as much wood pulp and trash from the mine as possible in order to minimize clogging of the inner grids of the filters. Top slicing is used in the mine so wood presents a difficulty in milling.

Results of filter operation are shown in Table No. III. Copper-germanium concentrate from the filters is smelted to produce a copper matte in a specially designed electric furnace. Germanium and arsenic are fumed off, as is only 20 percent of the lead and zinc. These fumes contain from 4.0 to 9.0 percent germanium indicating a recovery from 85 to 90 percent.

END

Table No. I

Floatability of Renierite in Primary Copper Circuit at Kipushi Mill

Product	Germanium Parts Per Million	Copper Percent	Zinc Percent
Feed	220	10.73	9.62
Concentrate			
Nos. 1 and 2 cells	950	38.84	6.98
Nos. 3 and 4 cells	630	36.54	8.86
Nos. 5 and 6 cells	520	32.57	12.82
Nos. 7 and 8 cells	260	27.94	17.31
Nos. 9 and 10 cells	260	23.48	19.76
Nos. 11 and 12 cells	250	21.40	22.10
Nos. 13 and 14 cells	210	17.14	22.43
Reject to next step	30	2.00	10.13

Table No. II

Three Step Franz FerroFilter Operation for Germanium Recovery

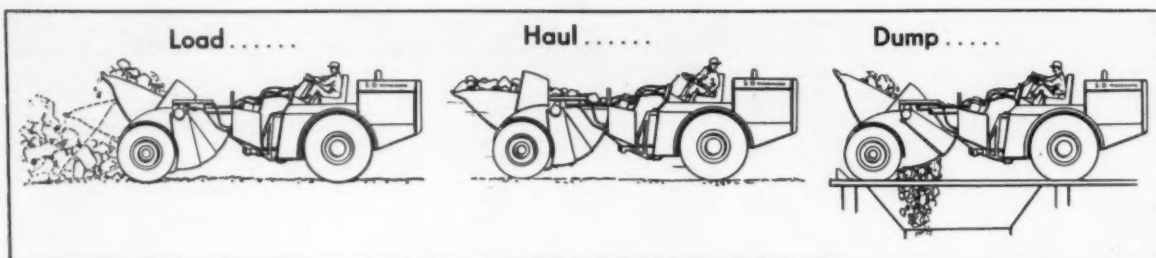
Cycle Time In Seconds	Feeding Pulp	Water	Current On Filter	Discharge Germanium Concentrate	Back To Flotation
0 to 90	Yes	No	Yes	No	Yes
90 to 105	No	Yes	Yes	No	Yes
105 to 135	No	Yes	No	Yes	No

Table No. III

Summary of Germanium Recovery During Two Three-Month Periods

	Period I		Period II	
	Tons	Percent Germanium	Tons	Percent Germanium
Feed to FerroFilters	32,757	0.130	28,281	0.099
Copper-germanium concentrate ¹	1,111	0.919	1,138	0.444
Germanium recovery	23.97 percent		17.88 percent	

¹ Concentrate has the following analysis in percent: Copper, 33 to 39; germanium, 0.4 to 1.2; zinc, 8 to 16; lead, 1.5 to 2.2; iron, 15 to 18; sulphur, 27 to 28; and arsenic, 0.7.



Self Loading Transport . . . Longhole Drilling . . .

By John Currie, resident manager, Grandview Mine, American Zinc, Lead & Smelting Company

A Note From the Editor . . .

Production per stope manshift has shot-up to 184 tons, a gain of 30 percent over previously recorded figures, at American Zinc, Lead & Smelting Company's Grandview mine. The primary impetus behind the gain was the conversion of the crawler-powered self loading ore transport (Gismo) to an all-rubber-tire mounted unit called the Transloader. The net result of this conversion was greater speed, more maneuverability and lower maintenance because shock loads inherent in the crawler-powered system were reduced.

The Grandview mine was the birthplace of the self loading transport now manufactured by Sanford Day Iron Works. Back in 1953 the mining industry was electrified by a report that development and use of the self loading transport had raised stope production per manshift from a little over 15

tons per manshift to over 120 tons per manshift. The self loading transport of 1953 was a relatively crude piece of machinery then, but it got the job done. Today it is a sophisticated piece of equipment that simply represents continuing improvement over the intervening period.

The primary feature of the self loading transport is the fact that one man loads ore at the face, trams the ore to a dump point, dumps the load and returns to the face. At the Grandview mine this haul distance (one way) may range up to 1,800 feet though 500 to 600 feet is considered a more satisfactory hauling range. With this condition in mind, the advantage of greater speed of operation through rubber-tire mounting and greater tractor horsepower becomes immediately obvious.

Perhaps even more important than the work capacity of the self loading ore transport, was the fact that the

Gismo system led to specialization of job functions at the Grandview mine. For example—a certain crew handled the drilling, another crew of self loading transport operators handled loading, tramping and dumping of ore, another crew did the blasting, etc.

Though the new rubber-tire Transloader has been responsible for most of the improvement in production efficiency at the Grandview mine, other changes have contributed toward the overall goal of reduced costs. Chief among the latter is the substitution of longhole drilling for core drilling in exploration. This change very nearly tripled the speed of drilling per shift, made information available more rapidly. Mr. Currie, resident manager at Grandview, describes latest results obtained with the Transloader, longhole drilling, and provides introductory remarks on conditions at the mine in the following sections.

Ore Is in Strong, Competent Dolomite Which Stands Well Over Wide Spans and

The mine is located in the Metaline mining district of northeastern Washington, approximately 95 miles north of Spokane, Washington, and two miles north of the town of Metaline Falls.

The zinc-lead ore occurs in the upper zone of the Metaline limestone, which has been altered to a silicified dolomite. Origin of the ores is considered to be replacement of the dolomitized limestone by ascending, hot, aqueous solutions. Access to the receptive host rock was provided by fault and shear zones which occurred prior to deposition. Occurrence is very irregular and ore bodies have been displaced by post ore faults of varying magnitudes.

There is no fixed relationship between the amount of lead and zinc

mineralization at any place. While certain sections of the mine may be essentially productive of lead ore, others may be mineralized with zinc ore carrying little lead. Any intermediate relationship may occur. For this reason, ore must be blended in the mine on a daily basis from the various headings to maintain a predetermined mill grade. Gradation from ore to waste may be abrupt or extensive, and stope outlines are difficult to project prior to mining.

The basic method is open stopes with random pillars. The rock stands well, and once backs are trimmed, they are maintained in a safe condition with little attention. Blast holes are drilled with 3½-inch drifters, jumbo mounted either on the Gismo stope drilling rig carrying four machines, or

on tractors carrying two machines. These units give good flexibility relative to the headings to be drilled, both as to size and type of round required. Blast hole diameter is 1½ inches, and depth of hole varies from 10 feet to 22 feet. Stopping is initiated by drifting to the lateral extent of the ore bodies, then recovering ore left in back, ribs, and floor. Stopping rounds will produce from 200 to 1,000 tons, depending on type of round, and size of the ore body that is available. Blasting is accomplished with 1¼-inch by 24-inch cartridges of 45 or 60 percent dynamite, detonated in all cases by electric blasting caps. Boulders set out by the Transloader are bulldozed with 1¼-inch by 8-inch cartridges of dynamite.

Blasted ore is removed from headings by Gismo and Transloader equip-

**Mechanized Mining Performance, Grandview Mine, American Zinc, Lead and Smelting Company,
May 1954 and 1959**

Item	1954	1959	Item	1954	1959
Total man shifts, stoping	127.625	109.875	Tons per man shift, mucking and transporting	418.86	550.35
Machine man shifts	84.875	73.125	Tons per total man shift	140.31	184.08
Holes drilled	3,124	2,493	Production		
Total feet of hole drilled	36,776	30,006	Tons of ore	17,906.44	19,789.39
Average depth of hole drilled, feet	11.77	12.04	Tons of waste	None	436.00
Feet of hole per machine man shift	433.30	410.34	Total tons production	17,906.44	20,225.39
Tons per machine man shift	210.97	276.59	Pounds powder per total tons, ore and waste	0.946	0.770
Man shifts mucking and transporting	42.75	36.750			

**Improve Underground Productive Efficiency at Northwest Lead-Zinc Mine
. . . By Boosting Tons Per Manshift 30% and by Tripling Exploratory Drill Speed**



LOADING ON INCLINES poses no special problem for the Transloader. This unit in a Grandview stope is completing its

loading cycle. Note how the unit builds its own road into muck pile and cleans up bottom as it advances.

Which Lends Itself to Application of Mechanized Methods

ment, and is delivered to the main rail transportation system through transfer raises. Faces are cleaned up for subsequent drilling by the Gismo and Transloader, with no hand mucking being required, except for occasional lifter holes in down-grade headings.

In the major production areas, ore is delivered to sublevel rail haulage drifts by transfer raises, where the ore is loaded into the train by pneumatically operated chute gates. Sanford-Day ore cars of 6.5 tons capacity discharge through bottom dump doors directly into the skip at the bottom level. All ore is hoisted through a 22½° inclined shaft by a 400-horsepower hoist located at the surface. The skip dumps into transfer pockets which deliver ore to the adit level haulage system

which is similar to the rail haulage system on the 500 level. Both the 500 level and adit trains are equipped with trolley locomotives, and each has a separate convertor to supply d-c power.

The mine is operated on a single production shift per day on a five-day week schedule, with maintenance crews scheduled to perform maintenance and service work when the equipment is normally idle. Ore production is approximately 900 tons per day, depending on mill requirements. Development waste is handled in the approximate ratio of one ton of waste for each 10 tons of ore.

Three major innovations have been initiated at the Grandview mine during the last 15 months. Most important is the introduction of the Transloader,

used for mucking and transporting ore in the stope production and development areas.

The Transloader is the result of the orderly development of the Gismo self-loading transport, originally designed by Mr. D. I. Hayes, to its present high mucking capacity, using the basic and original mechanical functions to load, transport, and dump broken material. A second innovation has been to adapt the percussion drill to the exploration of ore bodies in the Grandview mine, replacing the diamond core drilling method used formerly. The third innovation was to install two Diesel-powered personnel vehicles to improve supervision, and to perform other functions.

continued on next page

Transloader is Improved Version of Original Gismo; Uses Pneumatic Tired Wheels

The first Gismo self-loading transport was powered by a 30 horsepower, three drum slusher hoist. The second Gismo was equipped with self-contained electrical motors to power the mechanical functions. The third modification saw adaptation of a crawler track power unit to the transport. This resulted in very good flex-

ibility and tonnage performance. Rocker beam crawler-track supports on the transport unit were replaced with pneumatic tired wheels in 1957 and this improved the machine's performance substantially.

Early in 1958, design was initiated to power the Gismo unit with a two-wheeled, rubber-tired tractor, to take

advantage of the improvements experienced by application of the rubber tires to the loading end of the unit. Several types and sizes of tractors were considered before the Wagner Mixermobile power unit was selected. Reasons for this selection were its inherent simplicity of design and ready means of attachment to the Gismo, as

Tests Show That New Transloader Has Good Stall-Out Characteristics Even When

During the first year of operation the Transloader handled a total of 144,574.23 tons of ore. Haul distance varied from a maximum of 1,850 feet to a minimum of 350 feet. Performance tests and time studies were made shortly after the Transloader was put into operation, because this was the first machine of its kind, and it was necessary to determine its limitations under existing conditions. Also, future planning for development and operating conditions would hinge on the

machine's capabilities. Roadway grades in the Grandview mine are constructed to reach ore bodies above and below the dumping point elevations, and at grades up to 20 percent, both in favor of the load and against the load. Results of pull out tests on a typical roadway provided the following information about the Transloader which carries a 7.5-ton load.

With the tractor pushing the load from a standing start on a 20.5° percent grade, in low gear, the unit

travelled 43 feet up the grade and stalled out at 25 percent. Under the same conditions, in second gear, the load was moved 28 feet, stalling out on a 22 percent grade. Again pushing the load, with a three mile per hour moving start, the loaded transport was moved through the initial grade and up over a 25 percent grade, which was the maximum available. With the tractor pulling the loaded transport, stall out was experienced on a 21 percent grade. Wheel slippage on loose

Percussive Longholing Replaced Core Drilling as the Prime Method for Exploratory



MANEUVERABILITY of Transloader is important in this room and pillar stope where road winds between high pillars. Rubber tires make it possible to haul loads faster and cushion machine so that maintenance costs are low.

Adaptation of the percussion drill to long hole exploration is not original at the Grandview mine. The successful use of the method was observed by American Zinc Company engineers at the Lovitt mine near Wenatchee, Washington, and the Knob Hill mine at Republic, Washington, and the method was considered applicable to the conditions of the Grandview mine. It was especially appealing from a cost standpoint if satisfactory results could be obtained in the Meteline district ore zones.

Average 89.22 Feet of Hole per Shift

A total of 11,688 feet of exploratory drilling has been accomplished with the percussion drill. For the 162 holes drilled, this represents an average depth of 72.15 feet per hole, drilled at an average rate of 89.22 feet per shift, as compared to an average of 23 feet per shift with the core drill. Obviously, information is much more quickly available with the percussion drill.

Stopping predicated on information from this drilling has been very satisfactory as to grade of ore indicated by sludges. Most of the drilling has been in horizontal or up holes, but some down drilling has been accomplished. Down holes present a problem of sludge return, especially in high grade lead ore, where the galena tends to bind bit and rods in the hole, making for very slow drilling. Cost-wise, the percussion drilling can be accomplished at Grandview for one-eighth that of core drilling underground.

For exploratory work, the drill is mounted on a two-wheeled, rubber-tired cart, which can be moved by the tractors of the mechanized equipment. All drill rods, bits, couplings, and other equipment are carried in the cart to eliminate as much as possible the waste time in mobilizing

in Place of Crawler Tracks for Greater Speed and Lower Maintenance

well as the desire to have a tractor with work-proven performance. Representatives of the engineering staffs of the Sanford-Day Company of Knoxville, Tennessee, and the Mixermobile Company of Portland, Oregon, arrived at a satisfactory design, combining the tractor and Gismo unit and the first Transloader was manufactured in

August, 1958. After initial testing at the Young mine at Mascot, Tennessee, the equipment was exhibited at the American Mining Congress meeting in September, 1958, at San Francisco. In October, this Gismo Transloader was put in service at the Grandview mine, and it has been in continuous operation since that time.

A second Transloader was put in service in late October of 1959, and its performance is comparable to that of the first unit. No long term performance figures are now available relative to performance with two machines in operation, but it is anticipated that over-all performance will continue to show improvements.

the Unit Must Load Ore on Adverse Grades as Steep as 20 Percent

muck was found to be more prevalent with the tractor in the pulling position.

These tests proved that 15 percent grade should be the maximum.

Early time studies were accomplished to determine the feasible haul distances over various roadway conditions. Loading times were studied in muck piles of different characteristics such as fine or coarse muck, and combinations together with different roadway grades. Mucking on a 20 percent up-grade in coarse muck from a

bench heading and without calcium chloride in the drive tires, the operator, who had no previous experience with the unit, performed as follows.

Average loading time was one minute and forty seconds; average travel time for 1,320 feet round trip was two minutes and thirty-seven seconds. The total round trip time was four minutes and seventeen seconds, which represents 14 trips per hour, or the equivalent of 84 tons per hour.

A time study made two weeks later

in the same area, under similar conditions, indicated an average loading time of one minute and five seconds; travel time was one minute and thirty-five seconds, and total round trip time was two minutes and forty seconds. This represents 22½ trips per hour, or the equivalent of 125 tons per hour mucked and transported. Maximum performance was 960 tons in one shift, where five headings were serviced, and ore was blended for continue to show improvements.

Drilling Because Results Can Be Obtained Faster and Cheaper

the equipment. After moving to a new drilling location, air and water lines are connected, and the machine is ready for operation. Some rod sticking in especially long holes has been experienced, but they have been recovered with fishing tools designed for this purpose.

The drill was mounted on a standard jumbo to drill 55-foot blast holes to recover ore in high back-stoping. This has given very satisfactory results as to fragmentation, explosives and labor economy. It is anticipated that this method will be used in future wherever conditions are favorable.

Personnel Vehicles

Two Diesel engine powered vehicles were put in service underground in August, 1959. The Austin Gipse four-by-four is used primarily as a personnel carrier, and secondarily as a supply carrier. It has permitted elimination of one underground supervisor, and has improved the supervisory function substantially. The second vehicle is a Chevrolet panel truck, modified by installation of a GMC-271 Diesel engine. This unit functions essentially as a supply truck, and has improved material handling, as well as housekeeping, throughout the mine. For example, it is used to deliver drill steel and explosives to operating headings, and to remove broken steel, powder-boxes and other trash to the surface waste areas. With this unit, housekeeping is a matter of daily clean-up of the workings. Shift bosses use this vehicle in their rounds of the mine, and are able to expedite such on-shift maintenance that may occur.

The author and MINING WORLD are indebted to Howard I. Young, president, and R. E. Calhoun, manager of mining, American Zinc, Lead & Smelting Company for permission to publish this article.

END

Hourly Wage Payroll, Grandview Mine, American Zinc, Lead and Smelting Company, Months of May 1954 and 1959

	Number of Men Working	
	1954	1959
PRODUCTION—MINE		
Gismo operators	2	2
Gismo miners	4	4
Blast hole loaders	2	2
Roof trimmers	2	2
Miscellaneous	0½	0
Powderman	1	1
Blacksmith	1	1
Repairman	4	4
Watchman	1	1
Hoistman	1	2
Trainmen	3	2
Brakeman	1	0
Skiptender	1	2
Total Mine Production	23½	23
Tons per man, cumulative	36.28	40.97
PRODUCTION—MILL		
Flotation operator	3	3
Ball mill operator	3	3
Repairman and oiler	6	3
Crusher and helper	2	2
Mechanical utility	2	0
Electrician	0	1
Total Mill Production	16	13
Tons per man, cumulative	21.59	26.18
DEVELOPMENT—MINE		
Miners	4	2
Hoistman	2	1
Chucktenders	2	2
Head leadmen	0	1
Total Mine Development	8	6
Total tons per man, cumulative	17.95	22.44
Tons milled	17,906.44	19,789.39
Days operated	21	21
Average tons mined per day	852.69	942.35



For 1959 Achievements Mining World Honors

JOHNSON CRAWFORD

"Man of American Mining"

In October 1956 New Jersey Zinc Co. produced its first Tennessee zinc concentrate. Since that time, New Jersey has become the state's largest zinc producer. It has found, developed, and brought into production two 2,000-ton-per-day mines, built two modern surface plants, and two 2,000-ton flotation mills.

The man who has done most to bring this about is Johnson Crawford, assistant manager of mines for New Jersey Zinc, and manager of Tennessee operations. His training as a geologist was instrumental in finding the company's Jefferson City ore body beneath a flat fault.

The company's new Flat Gap mine

on Copper Ridge is many times more than a new mine. It is the first mine in an entirely new district. Johnson Crawford has played a key part in finding this district and bringing it into production. For geological skill, mine planning, operational know-how, and management ability, is truly Man of American Mining for 1959,

FOUR CORNERS EXPLORATION COMPANY

"Small Mining Company"

Proof that there always will be a small miner is the outstanding success of Four Corners Exploration Company which operates the Hogan uranium mine in Ambrosia Lake, New Mexico. Making a success of a small mine in this great district, right in the midst of multi-million dollar companies operating thousand ton a day mines, is a

tribute to the company's management. This success makes the company unanimous choice for small mining company honors.

There is no substitute for ore and the higher the grade the better. Four Corners has the ore but it took skill to find it and guts for a small two-man company to go ahead and mine this

wet ore in the district where it's nothing to spend a million dollars to bring a new mine into profitable operation. Four Corners has done both and has made money from the first shipment of ore. It wasn't easy because the mine has a bad swelling bottom to complicate mining, in addition to the typical water created problems at Ambrosia

IDARADO MINING COMPANY

"Underground Mine of Year"

Idarado Mining Company, operating a consolidation of famous mines in the high and rugged San Juan Mountains of southern Colorado, has been voted the Underground Mine of the Year for successful operation of a low-grade vein mine under adverse economic conditions.

Idarado's management, staff, and employees have all cooperated to achieve greater production—to break more tons per man shift. They succeeded, too, and in some stopes have broken 55.1 tons per stope crew shift. Remember that this figure was for a shrinkage stope in a 6.5-foot-wide

vein with an 80° dip where the miner does the work. It's not like a flat bedded deposit where the miner uses a multi-drill jumbo.

Technically, Idarado is an industry leader in bit and steel practices, high raise driving, and shrinkage stoping—truly the Underground Mine of 1959.

PIMA MINING COMPANY

"Open-Pit Mine of Year"

Pima Mining Company's deep copper pit south of Tucson, Arizona has been judged as the Open Pit Mine of 1959. This honor is a credit to the company and its engineering staff for making the decision to open pit the relatively thin but steeply dipping ore body. The company pioneered the use of an inclined skip haulage system in

the western United States to make open pitting of this ore body possible.

Operation of the pit during 1959 proved that the company had made the proper decision and, despite the peculiar dimension and attitude of the ore body, mining was very successful. The operating staff deserves great credit for mining this pit to a depth

of 480 feet with a surface length of only 2,000 feet and a width of 1,500 feet. By careful mining, production of 3,500 tons of ore per day has been achieved to overcome the problems of narrow benches and narrow roads. Today the bottom level of the pit is only 75 to 100 feet wide and 300 to 400 feet long. The pit will be mined an additional 100 feet in depth.

FRANK A. FORWARD

"Technical Achievement"

Frank A. Forward, internationally known Canadian metallurgist and head of the department of Mining and Metallurgy at the University of British Columbia in Vancouver, directed the industry's outstanding Technical Achievement. This is the new leaching process for recovery of zinc from ores and concentrates. This process involves the direct leaching of zinc

sulphides at low temperature and pressure in an oxidizing atmosphere to produce zinc sulphate and elemental sulphur.

The zinc sulphate solution can be purified and used as feed to an electrolytic plant for recovery of metallic zinc. The sulphide sulphur is oxidized to elemental sulphur and recovered as such. Iron in zinc concentrate has

no adverse effects on process.

Professor Forward earlier invented the high temperature and high pressure ammonia leach process for nickel refining used by Sherritt Gordon Mines Ltd. in Canada.

Truly a high honor to Professor Forward for his many technical achievements in the science of metal recovery and refining.



FOUR CORNERS EXPLORATION — "Small Mining Company of the Year".



PIMA — "Open Pit Mine of the Year" with skip hoisting system on north rim.



IDARADO — "Underground Mine of the Year", narrow vein stoping is an art.

Developments of 1959 Foretell 1960

With the world split into two major camps in 1959, it was the year of Coexistence. Each camp was more determined than ever that his own separate system, while diametrically opposed to the other, was the best.

For the United States it is Capitalism and it will continue to be. For Russia it is Communism. The most vigorous campaign by the most devious as well as forcible means was made to expand this philosophy into the Free World.

In final balance, however, neither camp sold the other very much, but Capitalism gained by peaceful penetration of the Iron Curtain through exhibits, trade missions, and tourists.

Technologically, 1959 was the year of space. This had far greater reaching and longer lasting implications to mining than might appear at first glance. The new space age, with its rockets and missiles, dealt a cruel blow to the long established metals for war. While metals and, increasingly, the more glamorous metals are key to rocket construction, total tonnage is low by any previous standard. One atomic missile replaces thousands of tons of steel, lead, aluminum, copper, etc. in aircraft carriers, bullets, bombers, and shell casings.

What can the mining and metallurgical industries do in the Golden Sixties to prepare for the true conquest of space in 1970? Never has the challenge for metals technology been as

demanding and exciting as that for space travel. The environmental beasts of the space jungle are led by temperature. Temperature limitations of metals and alloys in both atmospheric and space flight promise to be the most difficult to overcome.

Once temperature has been conquered, the other problems—resistance to micrometeoritic erosion, deterioration in the presence of intense radiation, high vacuum, and ionized gases—will be of small importance.

Here are the important developments of 1959 which set the industry's pace and pattern.

Beryllium has been judged to be the **Metal of the Year**. Space vehicles may take important amounts of beryllium metal in years ahead. The mining and metallurgical industries are ready. Discovery of a low-grade large tonnage deposit of beryllium minerals at Mt. Wheeler is described elsewhere. Another development was establishing the fact that every high temperature vein should be considered a potential beryllium source following profitable beryl vein mining at the Boomer mine in Park County, Colorado.

Question of the Year concerned uranium reserves. It was—when will a re-evaluation of reserves announced on July 1, 1959 be made? Many industry leaders questioned mineability of the measured, indicated, and inferred tonnages. Or questioned how much of the reserve was inferred. An-

By George O. Argall, Jr.
Editor

other big question—can the published grade actually be mined over the large tonnages reported in Wyoming and New Mexico?

Metallurgical Development of the Year was made by the U. S. Bureau of Mines. Electrolysis of a fused salt bath of a mixture of tungsten concentrates (including powellite) and alkali phosphates or borates to selectively produce high purity molybdenum and tungsten metal.

The **Alloy of the Year** was placed on the market late in the year. It is "T-Metal," a secret alloy of zinc, titanium, copper, and an unrevealed element. Projected sales of this new alloy are 32,000,000 pounds in 1960.

Discoveries of the Year point out the fact that just how big a business discovery of mineral deposits is today. Yet the very companies that are spending so much money, time, and energy on discovery view others, including the technical press, most often with suspicion. Nevertheless, uncertainties of discovery and changes in metals use and demand lead to the certainty of change. Today the mining industry must live with and meet the vast and revolutionary changes of the space age. In making any evaluation of mineral properties it is mandatory to recognize this new built in factor of change.



Geologist's Discovery of the Year was the recognition of beryllium minerals in mine workings at Mt. Wheeler Mines near Ely, Nevada. This discovery represents a break through in beryllium geology and may be the long sought large tonnage low grade deposit. Phenacite (Be_2SiO_4) and possibly a new mineral have been identified in mine workings in the "Combined Metals" limestone bed which had been developed for scheelite, lead, and zinc production.

The **United States Discovery** was the large low grade deeply buried oxide copper deposit near Safford, Arizona found by Bear Creek Mining Company's surface diamond drilling. True importance of this discovery

can't be finally evaluated until tonnage and grade are exactly determined.

Underground Discoveries continued to be made in the Coeur d'Alenes where crosscuts picked up at least three unknown veins. Bunker Hill Company found what is now known as the Veral vein on the 11th level. Nearby, the Sunshine Mining Company discovered an unknown vein in the footwall of the Chester fault and developed silver lead ore. The third important Idaho discovery was in the Galena mine where American Smelting and Refining Company found a silver-copper vein on the 3,000-foot level north of the Galena fault.

Canada and South Africa share the spotlight of **Foreign Discoveries of 1959**. All the major mining and financial groups in South Africa are making important searches for unknown gold deposits east, south, and west of Johannesburg. Search in the Orange Free State extends miles southeast of

the established mines. There is no question but that ore bodies on which new mines will be developed have been discovered.

Canada's exploration minded mining industry continues to make discoveries from British Columbia to the Northwest Territories and east to Quebec and Ontario. Competition was keen and at this writing there appears to be nothing in 1959 that matched Bell River-Mattagami of 1958. Gold received increased attention during the year and several important discoveries resulted.

In base metals, Mattagami Lake and the Mattagami Syndicate continued in the news after the spectacular success of 1958. This was west of Mattagami and is known as Grasset Lake; it lies astride the Ontario-Quebec boundary. More than 1,000 claims were staked to cover anomalies located by aerial magnetic and electromagnetic surveys.

Prospector's Discovery of the Year

Start of The Golden 1960's

Metals To Watch In 1960 . . .

Make no mistake about it, this is the year of space! Ahead lie the years of space travel. This gives the mining and metallurgical industries their greatest challenge—to find or develop a new group of light, strong, thermal stable metals and alloys for space vehicles. Ceramics, super alloys, and spectacular combinations of materials will be available as needed without question.

Here are some opinions on how mining will fare and what the metal picture will be in the year ahead. While some are predictions, others range from engineering estimates to plain hunches.

Iron ore production should exceed 105,000,000 gross tons for the third highest peace-time year. With increased taconite shipments from three mills in Minnesota and three mills in Michigan, total iron units shipped may well exceed those contained in the all-time high—117,994,769 tons in 1953.

Copper production, mine basis, should be well over 1,000,000 short tons. Price will hold firm and, if high demand holds through fourth quarter, the all-time high of 1,117,580 short tons could be exceeded.

Zinc output should be about 450,000 short tons. Statistically and market-wise, zinc occupies a favorable position so that output might well exceed 500,000 tons.

Lead demand has been only fair and there is nothing on immediate horizon to expect it to get better. No appreciable change is foreseen in mine output.

Molybdenum demand has remained remarkably high despite the steel strike. Foundries and exports have consumed virtually every pound mined. Copper strike has cut byproduct output so that less molybdenum was produced. In contrast to virtually every other metal mined in the United States, molybdenum enjoys a substantial export market, so with a broader marketing base it is less affected than other metals by overproduction in any part of the world.

Potash output will grow slightly. Markets have been good but prices have not advanced so operations must be efficient. The long heralded Canadian potash district in Saskatchewan has encountered serious mining problems that will take time and money to correct.

Phosphate production will expand at an even rate with population and industrial growth. Western, largely Idaho, production has zoomed in recent years with new mines and plants. This growth will slow, but western phosphate will increase in importance in the years ahead. Utah is the state scheduled for future major expansions.

Mining Will Expand In These States . . .

This review has consistently pointed to **Tennessee** as a growing zinc district, in fact, in 1954 it was pointed out that if you wanted to look for zinc, then go to Tennessee. Every prediction has come true and in 1958 Tennessee was the largest zinc producing state for the first time. It led again in 1959 and, with this forecast for new shafts, mines, and mills, there is nothing in sight to displace Tennessee for several years.

Michigan copper discoveries in 1958 and the few previous years are so important tonnagewise that at least two 10,000-ton-per-day operations could be developed. Mining problems, high capital cost for such operations, and increasing sources of copper from new mines are problems to be solved before such operations can be brought into production.

You can look for increased production of taconite pellets from Michigan. One authority has termed the three flotation plants now treating specular hematite as mere pilot plants. With expansion of one plant already underway, there are definite design plans for further expansion of other plants—in fact, engineering work has already started for an immediate expansion with a doubling of output in the long range contemplated.

Watch **Wyoming** stripping grow is the best way to predict future activity in that uranium state. While under-

which might well be the foreign tungsten discovery of the century was made near the Yukon-Northwest Territory border. Prospectors of the Mackenzie Syndicate found mineralization very late in 1958 and secret drilling in 1959 indicated a high-grade ore body. One vertical hole showed 156 feet of 2.41 percent WO_3 .

Records were made, broken, and new records set by South African shaft sinkers. As of December 1 the world record for shaft sinking in one month was held by the President Steyn Gold Mining Company, Limited. This was 1,001 feet in November at its new round shaft in the Orange Free State. It was the first time in history that any shaft had been sunk more than 1,000 feet in one month and was a goal long sought. Shaft bottom was 1,312 feet at end of month. What will happen in December remains to be seen as Vaal Reefs Exploration and Mining Company Ltd. also broke former record in December

when it sank its No. 2 shaft 954 feet from 2,802 to 3,756 foot depth. In September Vaal Reefs had regained world record by sinking 922 feet in the same shaft.

Other records claimed during the year were: Utah Construction Company's crews claimed an Australian record and world record of 563 feet in a 6-day week at the Providence portal of the Murrumbidgee-Eucumbene tunnel.

World's record for tunnel boring was set by Morrison-Knudsen Company, Inc. and Associates for drilling 110 feet of 30-foot-diameter tunnel through shale at the Oahe Dam in South Dakota. A 100-ton cutter head with 37 fixed teeth and 42 revolving teeth was used. It burrowed 1,152 feet in just 22 days.

The United States record for iron ore taconite (shipments) was made by Reserve Mining Company when seven Lake vessels were loaded with 72,400 tons of pellets, from stockpile, in 24

hours following end of the steel strike in November.

From five to 101 years read the important **Mining Birthdays in 1959**. Iron Ore Company of Canada reached its fifth shipping birthday as it celebrated 10 years of existence. Texas Gulf Sulphur Company celebrated 40 years of sulphur production from Boling Dome as the company became 50 years old. Mesabi Iron Company had its 40th birthday.

The Chino Mines Division of Kennecott Copper Corporation had its 50th birthday. The famous gold camp of Porcupine, Ontario, Canada observed its 50th year of mining. In April, American Smelting and Refining Company observed its 60th birthday. First iron ore mined in Minnesota came from the Soudan mine on the Vermillion Range 75 years ago.

Gardner-Denver Company started its second century of business in supplying equipment to the world's mines.

Space Travel Demands New Mines and Metals

ground mine development and mining have been started in three districts, there remain several problems to be solved before high tonnages can be easily mined. Open-pit mining has been so successful that plans are being made to further mechanize stripping so that operations could well reach a new peak in United States metal mining.

There's plenty of room for a new trona mine in Wyoming. It could happen any time, too, because at least four large mining and chemical companies have developed reserves.

Copper means **Arizona** and Arizona means copper, with new exploration projects, new discoveries, new mine developments, and new mills. Not all the deposits in the Tucson area have been discovered, so it's still a good place to look in view of the development of 650,000,000 tons of ore reserves in the last several years.

Arizona is crawling with copper seekers, new processes are being used to recover oxides, and two new deep exploration shafts are to be sunk. Much attention is focused on recovery of small oxide copper content in sulphide ore being sent to large flotation mills.

When will the reassessment and revaluation of **New Mexico's** uranium reserves be completed? While there has been only very limited prospecting for unknown reserves, there has been a great effort, largely by underground drilling, to more accurately locate, delimit, and sample the uranium ore bodies in Ambrosia Lake. Much of this drilling has been from existing mine workings.

Will **Colorado** see the development of remote controlled jet stoping of flat dipping ore bodies? Vertical veins in Utah are mined by hydraulic jets and surface control of these units is on the drawing board. Active exploration for molybdenum in Lake County, Colorado has indicated some promising areas. Don't be surprised if a new mine is developed on one of these deposits.

Utah lead and zinc discoveries during the last year have been so important that there is no question but that at least one new mine will result. The most optimistic geologists feel that one discovery is even more important, and

well may result in a new mining district.

Montana could have a new mining look—molybdenum. A promising deposit has been explored in Cascade County. Grade is O. K. if tonnage can be doubled. A vast expansion of open-pit mining at Butte over the next 10 years could change several square miles of surface on "The Richest Hill On Earth".

Missouri will continue in the exploration spotlight again this year. The new and high-grade Viburnum lead belt has attracted many companies to the state. A major copper producer continues active and has found lead in a series of drill holes. Deep exploration for iron led to a copper discovery which awaits final evaluation only after more holes are drilled.

Nevada iron was underestimated last year at only 30,000,000 tons of 30 percent in one deposit. Drilling and geological studies now indicate assured reserves of 46,000,000 tons of 29.2 percent iron with 86,000,000 tons partly proven.

Now for some equipment forecasts: The electric-wheel drive trucks are here to stay. You will see more and more of them in the copper and iron pits. High pay loads, maneuverability, speed on the grade are all big advantages. You can look for a new 10-yard electric shovel for faster loading of these units.

Copper mining may shift to **Puerto Rico** in the years ahead. A major drilling program by a western copper miner has already yielded several holes showing up to several hundred feet of less than 1.0 percent mineralization.

Above all don't be surprised if you hear more, much more, about V/O Machinexport and V/O Technoexport! They both are in **Russia**, have Moscow addresses, and could well be new weapons in the economic war between the two camps.

The first firm exports mining equipment, compressors etc. The latter exports complete equipment for iron and steel plants, mines, nonferrous plants, ore dressing mills, transmission lines, and other electrical equipment.



TRUSTEES of the Northwest Association hold meeting at convention to outline active program for the mining industry in 1960. Left to right: C. E. Schwab, W. H. Love, J. W. Currie,

F. N. Marr, A. Y. Bethune, H. E. Doelle, R. B. Austin, D. A. Pifer, D. E. Watson, E. K. Barnes, E. H. Lovitt, A. R. Patterson, W. Farmin, E. C. Stephens, and R. D. Leisk

Northwest Speakers

Predict Higher Gold and Silver Prices

The 65th annual convention of the Northwest Mining Association in Spokane, Washington, December 4 and 5, drew a record attendance of nearly 1,000 mining men. Officials credited this record turnout to a program with broad appeal to all segments of the industry and excellent papers on technical subjects by recognized experts in their fields.

Those who came seeking signs to indicate better days ahead were not disappointed. Predictions on the future of metals in general, and on gold and silver in particular, were decidedly bullish and an air of optimism prevailed.

The program, with more speakers than ever before, offered sessions on the economics of metals, metallurgy, new developments, exploration, mining and government, geology, and mine operating.

Industrialization of underdeveloped nations and a universally high standard of living will create a "staggering" world demand for metals, said Sherwin F. Kelly, president of Sherwin F. Kelly Geophysical Services, Inc., Amawalk, New York, and Geophysical Explorations, Ltd., Toronto, Canada. Whether it can be met depends on improvement of geological, geochemical, and geophysical techniques for finding new ore deposits. Prospecting and exploration for minerals is in a state of development as rudimentary as the hand-spinning and hand-loom-

ing of textiles in a country cottage, he said.

A "substantial" gold price increase following the 1960 presidential election, barring unforeseen international incidents, was predicted by Franc R. Joubin, Vancouver, B.C., president of British Columbia's largest gold producer—Bralorne Pioneer Mines, Ltd. The discoverer of Canada's famed Blind River uranium field said gold mining is becoming "psychologically decent" again and once more is attracting the attention of competent executives, technical men, labor, and capital. He also pointed to the mounting interest in gold securities and bullion as "physical insurance" against continued inflation or a recession.

Decrying the flight of gold from the United States Treasury, L. L. Huelsdonk, general manager, Best Mines Company, Inc., Downieville, California, said a "realistic official devaluation is the only sure-fire step that can halt the trend of dollar embarrassment."

A higher price for silver was seen by Clark L. Wilson, Salt Lake City, Utah, vice president, New Park Mining Company, as the metal's uses expand and Treasury supplies dwindle. He said that industry finally has recognized the unique chemical and physical properties of silver. New silver-zinc batteries, he said, weigh only one-sixth as much as conventional batteries and a constant voltage dis-

charge rate offers great attraction for use in jet aircraft, guided missiles, torpedoes, cameras, and portable television.

The operation within a grinding mill is primarily a mathematical process, Fred C. Bond, consulting engineer for Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin, told a metallurgy session. Some of the factors still are not determined, he said, but a detailed study of available data can indicate the importance of factors which have been neglected. The former professor of metallurgy at Colorado School of Mines cited extensive calculations applied in finding the deficiencies of a rod mill.

Mine Operating Session

Using a new breakage process equation and principles of rock mechanics has made it possible to appraise blasting practice to determine whether it can be improved, and if so, how, the mine operating session was told. The speaker, Clifton W. Livingston, president, Barodynamics, Inc., Georgetown, Colorado, said the equation was developed from a concept known as the "theory of relative behavior of materials."

Development of a new exploration tool—a mobile spectroscopic laboratory—by the Spokane office of the U. S. Bureau of Mines was reported by Eldon C. Pattee, mine examination and exploration engineer. The mobile

unit determines elements present in rocks by volatilizing samples in an electric arc. It is being used in Idaho and Montana reconnaissance.

More circular shafts will be sunk in western mining camps because of natural and economic pressures, James Quigley, vice president, Centennial Development Company, Eureka, Utah, predicted. He cited greater strength because of walls being in compression; better control of heavy water inflows; less resistance to air flows, suitability for modern mucking and drilling machinery, and low maintenance costs.

Use of percussion drills for long-hole exploration work at the Grandview zinc-lead mine at Metaline Falls, Washington, has proved nearly four times faster than diamond drilling at one-eighth the cost, reported John W. Currie, resident manager for American Zinc, Lead and Smelting Company. Average drilling rate is 89 feet per shift, versus 23 feet with the core drill. Ore handling also has been improved considerably through installation of a Transloader. It combines the company-developed Gismo and a two-wheeled, rubber-tired tractor manufactured by Mixermobile Company, Portland, Oregon. Underground mining operations also have been improved through use of a Diesel-powered Jeep as a personnel carrier and a Diesel-powered truck as a supply carrier and housekeeping unit. See page 36 for Mr. Currie's full report.

American Zinc Company's Tennessee mines were described by president Howard I. Young in a paper read by William Black, resident manager. The ore body at the Young mine is shaped like an inverted saucer with a diameter of around 8,500 feet, he said. Cost of loading with the Transloader this year is \$0.14 per ton, including

\$0.05 per ton maintenance costs, but excluding \$0.09 per ton for amortization of the cost of equipment. A round ventilation shaft, 66 inches in diameter, was sunk to a depth of 650 feet with a Calyx-type drilling machine at a cost of less than \$100 per foot.

Nearly 300,000,000 tons of ore has been mined at Butte, Montana, in its 95-year history, yet reserves are sufficient for at least 50 more years of operations, E. I. Renouard, vice president in charge of western operations for The Anaconda Company, said in a paper read by Andrew R. Sims, general superintendent of mines at Butte. The company has spent \$80,000,000 in the last 12 years to bring in its new low-grade operations and is contemplating expenditure of several million dollars for mining at Butte and additional millions to enlarge and further modernize metallurgical plants at Anaconda and Great Falls, Montana. Designers are working on plans for a large, deep-level hoisting shaft which will be sunk 4,600 feet initially and even deeper later. Large haulageways will accommodate big cars in one-way traffic. Another openpit mining operation east of the big Berkeley pit is included in future plans.

High temperature metals, titanium pigments, and industrial phosphate chemicals are being eyed for further diversification by the Bunker Hill Company, north Idaho producer of lead, zinc, silver, cadmium and sulfuric acid. Wallace G. Woolf, vice president in charge of Kellogg operations, read a paper prepared by the late John D. Bradley, company president killed in an automobile accident near San Francisco, California a few days before the convention.

C. E. Schwab, new Bunker Hill general manager and retiring chair-

man of the National Emergency Lead-Zinc Committee, predicted that the United States Tariff Commission will reject the current petition of six importing smelters to set aside import quotas.

The origin of Idaho's Coeur d'Alene district ore deposits and their possible relation to some large-scale structural features was discussed at the geology session by Arthur H. Sorensen, research geologist for Hecla Mining Company, Wallace, Idaho. Increasing use of geochemistry and techniques of isotopic analysis of ores and rocks in recent years has aided progress in large-scale structural interpretation of the geology of the Pacific Northwest, he said. Analysis of Coeur d'Alene, Idaho, district ore samples yielded an "amazingly uniform" lead isotope ratio indicating an average age of 1,400,000,000 years. Ores from the Sullivan mine at Kimberley, British Columbia, have been determined by the same dating methods to be of the same age, he said.

E. K. Barnes, retired Spokane banker, was reelected to a third term as president of the Northwest Mining Association. Ross D. Leisk, Spokane consulting engineer, was reelected a vice president, and Frank N. Marr, a Bunker Hill lessee and general chairman of the convention, was reelected treasurer. Malcolm C. Brown, Kellogg, Idaho, president, Sidney Mining Company, was elected a vice president and Robert J. Towne, Spokane equipment dealer, was elected secretary.

E. C. Stephens, geologist in charge of Anaconda's Northwest exploration office in Spokane, was assistant convention chairman under Marr. Frank C. Armstrong, United States Geological Survey, Spokane, was program chairman. END



CONVENTION GENERAL CHAIRMAN, Frank N. Marr (far left), welcomes Canada's famous uranium geologist, Franc R. Joubin, to meeting. Mr. Joubin discovered Canada's Blind River



uranium. Association officers for 1960 include Ross D. Leisk, vice president; Frank N. Marr, treasurer; E. K. Barnes, president, all of Spokane; and M. G. Brown, Kellogg, vice president.

Seismic Tables Pinpoint Ripper Performance

... of Cat D9-No. 9 Unit with Wave Velocity

The table at right relates ripper performance to seismic wave velocities for various rock materials and was released by Caterpillar Tractor Company. It was specifically developed as a guide for determining whether overburden should be ripped and scraper-loaded, or drilled and blasted for shovel loading. Over 500 tests were conducted by Caterpillar as a basis for this information.

The new seismic method for determination of rippability of overburden was described in MINING WORLD, November 1959, pages 46 and 47. The equipment required to conduct a simple seismic test consists of an 8-pound sledge hammer, a steel plate, a refraction seismograph, a geophone receiver, and a coil of wire.

Operating procedure for conducting the seismic test over an unknown area is said to be simple. An electronic counter housed in a metal container operates on self contained batteries. The geophone is plugged into one receptacle on the counter face. A long wire is plugged into another receptacle and connected to a spring contact switch on the hammer. The steel plate, when hit by the hammer, is said to produce a sufficiently strong shock for readings to a 50-foot depth under most soil conditions. Blasting caps wrapped in a couple of feet of primacord may be used if stronger waves are needed.

When the sledge strikes the plate,

Material	Seismic wave velocity in thousands of feet per second														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
TOPSOIL															
CLAY															
BOULDERS															
SHALE															
SANDSTONE															
GNEISS															
LIMESTONE															
GRANITE															
BRECCIA															
CALICHE															
CONGLOMERATE															
SLATE															

PREPARED BY CATERPILLAR TRACTOR CO.

COULD BE RIPPED MARGINAL ZONE COULD NOT BE RIPPED

shock waves are produced in the ground and the switch closes, starting the counter. When the first wave reaches the counter through the geophone, it stops the counter. Time is recorded in milliseconds by flashing lights.

The first reading is made at 5 to 10 feet from the geophone. Successive readings are taken in a line from the geophone in 5- or 10-foot stations, depending on the overburden and conditions.

Velocity of the wave is found by the

formula listed below, where V is the velocity, D is the distance from the plate to the geophone, and T is the time lapse.

$$V = \frac{D}{T}$$

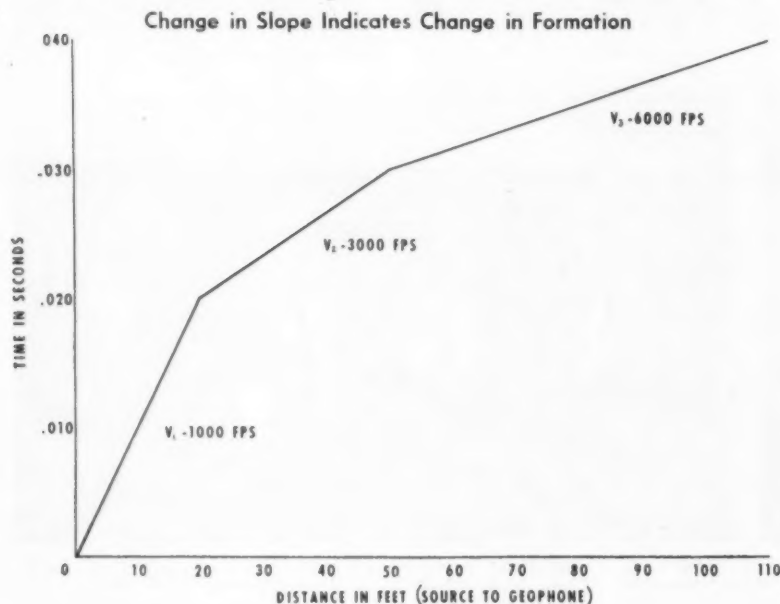
Readings obtained from a series of tests can be plotted on a graph, with time representing one axis of the graph and distance from plate to geophone the other axis. Changing slope of the graph indicates changes in composition of the overburden.

Depth at which formation changes take place is computed by the following formula, where D is depth, X is the horizontal distance from geophone to change in formation (indicated by change in graph slope), V_1 is the velocity of the seismic wave in the upper layer, and V_2 is the velocity of the wave in the next lower layer.

$$D = \frac{X}{2} \sqrt{\frac{V_2 - V_1}{V_2 + V_1}}$$

Accuracy of the tables has been established by running tests under known conditions and by checking ripper performance after tests. Rippable and non-rippable velocities were determined for each of the 12 overburden conditions listed in the table. In nearly every case, a marginal zone separates rippable and non-rippable velocity. If wave velocities for a particular rock formation in an unknown area fall within this questionable zone, rippability must be determined by operator experience.

The seismic method will not yield satisfactory results when ground is



frozen because it is so consolidated that the surface wave almost always reaches the counter ahead of the subsurface wave. Seismic analysis will not reveal the presence of softer materials below harder layers, such as in cap rock areas.

Some operators have found completely unrelated uses for the equip-

ment. One knew he had sandy clay as deep as he could go, but was able to locate the water table because of increase in wave velocity.

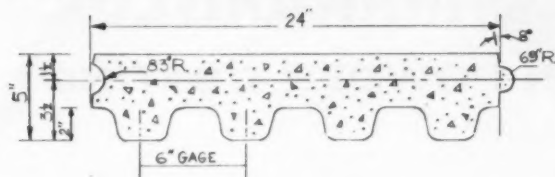
The seismograph, including self-contained batteries, is available from Geophysical Specialties Company, Hopkins, Minnesota. It is reported to cost less than \$3,000. A day of practice

with the equipment under known conditions is said to be sufficient to develop reliable accuracy.

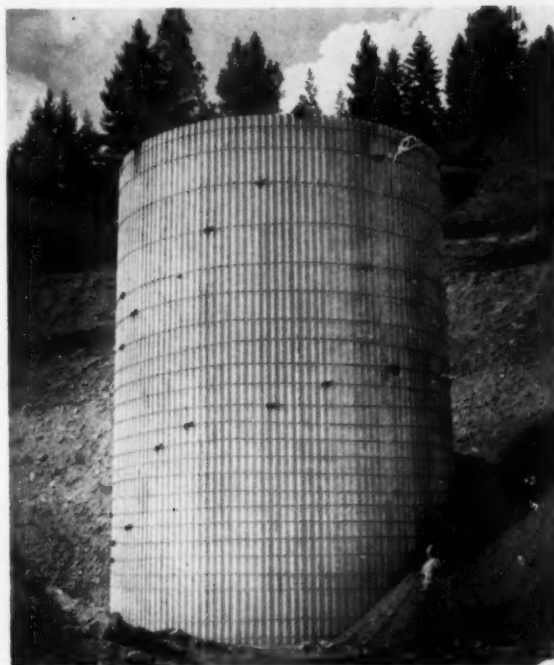
For earth moving, ripping can not be considered a cure-all. Where overburden can be scarified and picked up by scrapers, however, it may point the way to cost reductions through judicious application of equipment.

Low-Cost Ore Bin Can Be Erected in a Hurry

Concrete staves with this cross section



Placed side-by-side and banded with cable



. To make this finished ore storage silo

Interlocking concrete staves that measure 24 inches wide by 35 feet long were tilted on end and banded with steel cable to make a 24-foot-diameter fine ore silo for Lucky Friday Silver Lead Mines near Mullan, Idaho. It took the contractor just four days to finish the job after the foundation had been poured. With this experience under his belt, he figures the project time can be cut in half.

Lucky Friday, operated by Hecla Mining Company, built a new 400-ton-per-day mill for the Idaho silver-lead producer. Hecla's former mill superintendent, Jim Hunter, first approached a Spokane, Washington, concrete products firm to inquire what they could do in the way of ore bins. Lee Patchen, manager of Pre-Con Inc., developed the concrete stave method and the Lucky Friday project was the first using the staves. Reports Lee, the method is consider-

ably cheaper than using slip forming for a concrete silo in isolated instances where only one or two bins of a certain size are required. If a series of silos of standard size are involved on a single project, then the use of slip forms holds advantages.

The Lucky Friday bin was designed to hold about 1,000 tons of ore. The staves, which are 3 inches thick at the section between the webs, contain eight, unstressed steel bars for reinforcing purposes. They are cast with a bead on one side and a keyway on the opposite side to gain the interlocking feature. Each stave contains 5,000 pounds of concrete, and it took 38 staves to complete the ring for the fine ore bin.

The staves are picked up at the center by a truck-mounted crane, swung in midair, and placed on the concrete foundation. They are clamped at the top with metal brack-

ets for temporary support. Guy wires are used to balance the semi-finished bin until the silo is closed in. The concrete staves have a great deal of flexibility and they can be flexed sufficiently so that they can be interlocked with adjacent stave as the work progresses.

As a final step, the bin is wrapped with a series of steel cables. Each cable is tensioned to 10,200 pounds with a hydraulic jack. Under full load conditions, the bands will be stressed to 14,000 pounds per cable, but the bin will still be in compression.

A second similar silo was erected at the Lucky Friday plant to serve as coarse ore storage for the surface crushing plant. Thicker staves (5 inches between the webs) were used for the latter bin to provide a larger capacity. Lee Patchen reports that his design is workable for bins from 16 to 30 feet in diameter.

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today! Compare it with every other manganese electrode you've *ever* used...you'll agree it's the best in the field! Your Stooddy dealer will be glad to have you test it on your own job!

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(Based on tests by independent laboratory)

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Yield Strength	67,000 psi	66,000 psi
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Hardness—Single pass on manganese steel; as deposited—15 Rc, as work-hardened—48 Rc.		
Two passes on manganese steel; as deposited—18 Rc, as work-hardened—48 Rc.		

STOODDY COMPANY

11932 East Slauson Avenue
Whittier, California

PRODUCTION EQUIPMENT PREVIEW

For data on any item on next three pages
use the inquiry card opposite page 50



Breaking Fragmentation with Truck Crane

The 40-ton P&H 565A-TC is one of five new truck crane models introduced by Harnischfeger Corp. Capacities range from 35 through 80 tons.

Drop-ball secondary fragmentation of pre-blasted material in open pit mining has proved a popular application for the 40-ton model. According to the company, truck cranes are preferred for such work because of the wide spread ground bearing points of their wheels. Also, pneumatic tires help dissipate impacts created by release of the ball.

Among exclusive features of the P&H 565A-TC is a patented method of transmitting power electro-magnetically for swing. This system, called Magnetorque, eliminates friction clutches and requires no lining replacements, adjustments or maintenance. The machine also has a sealed power box in which all gearing is completely enclosed and runs in a bath of oil. Circle No. 15.



Hydraulic Drill with Selective Rotation

A new, light weight hydraulically powered drill with selective rotation, clockwise or counterclockwise, is now manufactured by Arrow Manufacturing Co., Denver, Colorado.

The new Arrow Hydrotro Drill is made heavy and rugged for rough use in mining, yet light enough to be air lifted or burro packed for use anywhere. It is easily operated by one man, and breaks down into four easy-to-manage packs. Total weight without hydraulic fluid is 500 pounds. Used as a drifter or core drilling unit, the drill may be column mounted, truck mounted, skid or jeep mounted. The unit will drill at any angle, as it rotates 360° in both the horizontal and vertical planes. Any size drill rod to and including the "E" rod may be used.

Hydraulic pressure is used to turn the chuck and drill rod. This pressure is supplied by the power unit, which also supplies water under pressure. Circle No. 16.



Thermistor Psychrometer

A portable thermistor psychrometer, which accurately measures the moisture content of air by means of wet and dry thermistor beads, is a matter of seconds, has been introduced by Atkins Technical, Inc.

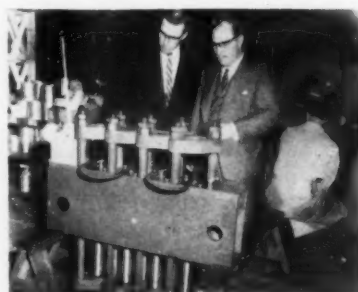
Called "A+Hygrophil", the portability and extremely rapid response features of the pistol-like instrument make it ideal for air moisture determination. Battery operated, the instrument is completely mobile

and is ideal for determining the relative humidity of the air at all desired points of a room in swift sequences; also, in closed spaces such as drying ovens and piping accessible only by a small hole into which an extension piece of the suction tube (barrel) can be fitted. Very little air is required for a reading as the heat capacity of the tiny thermistor is minute.

This instrument has three scales for measuring humidity in temperatures ranging from 10°F. to 176°F. Accuracy is within 0.5% relative humidity and readable within ¼°F. Circle No. 8.

Tractor Shovel

A new 1½-yard tractor shovel of advanced design has been put into production by Allis Chalmers Manufacturing Company. Powered by a four cycle Diesel engine, the dumping height of the new unit is said to be over nine feet. The curved-bottom bucket tips back 40° at ground level, with 21,500-pound pry out force at the cutting edge. The HD-6G is a track mounted crawler. Circle No. 58.



Hydraulic Equalizer

A new assembly for mine skips and cages equalizes multiple rope suspension and is used with friction type hoists, reports Lakeshore, Inc. The unit is said to be capable of compensating for a larger amount of variation in rope lengths than common types of linkage systems. The one shown above was designed for installation at a mine in the Lake Superior District. Circle No. 55.



AFMAG Airborne Surveying System Utilizes Audio-Frequency Magnetic Field

Completion of the first U.S. surveys using a new airborne surveying system, known as AFMAG, has been reported by Fairchild Aerial Surveys, Inc. AFMAG is a system utilizing a relatively little-known natural field of the earth, the audio-frequency magnetic field, in the search for conductive metallic ore-bodies. These are most frequently the sulphides of copper and lead, with their commonly associated valuable metallic content.

Airborne AFMAG has detected surface deposits of massive sulphide ores while being flown at elevations as great as 3,000 feet. Hence, by inference, it can be deduced that it could find similar sulphide bodies if they were buried as deep as 2,500 feet, with the aircraft flying at 500

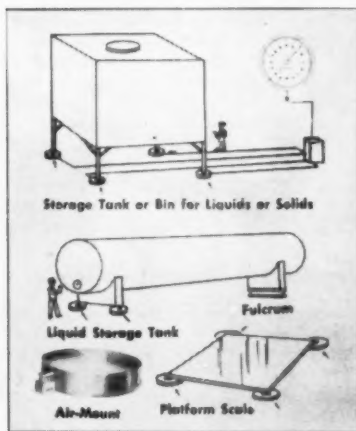
feet above the terrain. This great depth of response increases the dimension of ore search many-fold, since airborne methods of electromagnetic surveying (which use an alternating field generated in or around the aircraft in flight) are inherently limited to shallow depths of exploration, perhaps 100 or 200 feet below the earth's surface. Because of the limited depth response of such airborne electromagnetic systems, their use in hilly and mountainous terrain has not proved satisfactory.

The audio-frequency magnetic fields are normally considered as oriented parallel to the surface of the earth. The presence, however, of local conductive bodies, such as sulphide ore deposits,

distorts the AFMAG fields out of the horizontal. The airborne AFMAG detector measures and records the inclination of the fields from the horizontal. From the continuous records the interpreter determines the probable depth and conductivity of the conductive mass.

AFMAG instrumentation is not particularly bulky. During actual surveying, the AFMAG detector, in a spherical container about two feet in diameter, is paid out on a 300 foot cable astern and below the aircraft.

Aircraft position and altitude above ground are continuously recorded by means of a flight path camera and recording altimeter. For additional information circle No. 14.



Air-Mount Weighing System

The new Weber Air Mount System for weighing the contents of bins, tanks, truck tanks, conveyor loads and anything else that can be weighed on platform scales is now available for loads covering the entire range from 0-300 pounds to 0-200,000 pounds.

This new system is quick and easy to install. No changes in floor construction or foundations are necessary. The complete equipment and installation for a

four-legged 30,000 pound tank or bin or equivalent weighing problem can usually be obtained for less than 50% of the cost of conventional scales. Installation time is ordinarily less than an hour. The Weber System is operated by a small load-cell placed under each leg of a tank, bin, conveyor section, or other objects to be weighed. Linear Pneumatic pressure is automatically controlled in each load-cell and produces a pneumatic signal on a meter, which may be remotely located. Circle No. 11.

3-Piece Blade Arrangement

Paper, Calmenson & Co., recently announced a new system of installing grader blades. To reduce the crowning effect so the blades stay straight on the bottom, this new blade arrangement consists of a thicker hardened blade in the center, and two conventional blades on the ends.

In most applications, the old two-piece grader blade arrangements would wear down in the center or crown excessively, making good blading operations difficult and leaving excessive blade waste. This was due to the weight of the machine being on the center of the moldboard and also because the moldboard center was working on the high and hard part of the road. For further information on the Pacal X-Tra-Edge blade, circle No. 4.



35 Ton Rear Dump

Euclid Division of General Motors has recently announced the addition of a new variable wheelbase machine to its line of off-highway rear dump haulers. Designated as the Model S-18, this new "Euc" consists of an overhung engine type tractor with an Easton-built semi-trailer.

The S-18 tractor is powered by a GM 6-110 engine of 336 hp. It has an Allison 4-speed Torqmatic Drive with converter lock-up. A Torqmatic Brake is available as optional equipment. Top travel speed with full payload is 25 mph. Tractor and trailer tires are 27.00 x 33 and are interchangeable. Work requiring maximum traction and flotation, 33.5 x 33 tires are available as optional equipment. Circle No. 12.

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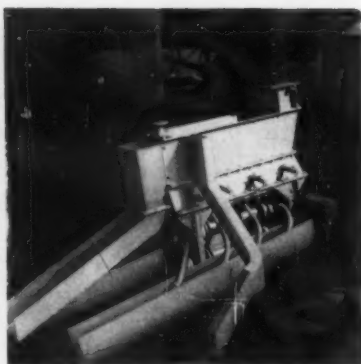


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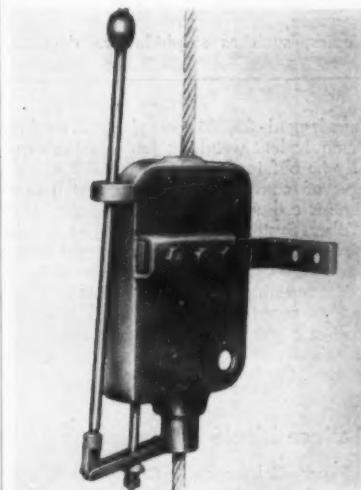
PAUL E. KEENEY CO.
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Pilot Size Jig

A pilot size version of the Wemco Remer-Jig, incorporating all the characteristics of the larger models has been announced by Wemco, a Division of Western Machinery Company.

The one foot by 3/4 foot bed, has a capacity of 1-3 tons per hour depending on the size and type of material being treated. This pilot-size jig features the same patented double-stroke jiggling action that is found on standard Wemco Remer-Jigs. It combines the speed and length of the conventional jig stroke with a separate high frequency pulsation to create greater uniformity of jiggling action, better stratification, accelerated settling of fines, and greater capacity per foot of bed. Circle No. 13.



Griphoist Safety Bloc Stop

Here is a positively acting independent safety device used for swing staging and personnel lifts. This device, known as "Blocstop," and distributed by Griphoist, Inc., fits directly on the hoisting cable of the staging setup. When staging is lowered, the Blocstop clamping jaws have to be released manually before staging can descend. Should a slip occur, release of the hand held jaw handle, will stop the descent. When staging is raised, clamping jaws within the Blocstop automatically open to allow cable to pass. If staging

should slip during hoisting process, jaws automatically lock.

Blockstops may also be used on independent safety cables in conjunction with hoisting cables. In this event, further protection is added should hoist fall, or hoisting cable break. For additional information and literature, circle No. 3.

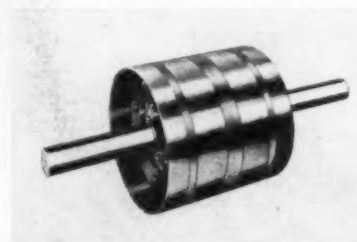


All-Hydraulic Motor Scraper

Allis-Chalmers Mfg. Co. has introduced a new all-hydraulic TS-360 motor scraper with a 30 cubic yard heaped capacity and a 22.3 cubic yard struck capacity. This 63,150-pound unit is powered by the Allis-Chalmers turbocharged 21000 engine, developing 340 hp at 2,000 rpm.

Double-acting hydraulic bowl lift jacks assure tremendous force at the cutting edge for penetration into tough-loading materials. Hydraulic power is furnished by a tandem pump, gear driven from rear of engine crankshaft to provide instant controlled response for positive steering and scraper operations.

The TS-360's double-acting steering jacks and multiplier links provide the unit with exceptional maneuverability, a 90° turn either way can be accomplished with only a one-sixth turn of the steering wheel. Full 180 degree turns can be made within a width of 35 feet, 8 inches. For additional information circle No. 6.



Permanent Magnet Pulleys

A complete line of Indox V permanent magnet pulleys, in diameters up to 48 inches, is now being offered for heavy-duty tramp iron removal and cobbing applications by Stearns Magnetic Products.

Through the use of Indox V magnet material in numerous installations of 12" through 24" sizes, Stearns has been able to extend their line to include pulleys of 30", 36", 42" and 48" diameter. Indox V, a highly oriented barium ferrite ceramic magnet material, provides pulley performances equal to the most powerful electromagnetic types at much lower cost. Permanent magnet pulleys do not require expensive coils, rectifiers, switches, etc., necessary for the operation of electro pulleys. With nothing to go wrong, there's no downtime with permanent pulleys. For complete specifications circle No. 7.

MORE NEW EQUIPMENT ... AND NEW LITERATURE

A NEWLY DEVELOPED DUST collecting system for use with hand held sinker drills is now being offered by Le Roi Division. It can be used with any brand of rock drills, according to the manufacturer. Operation of the dust collecting system is simple. Dust and cuttings are trapped by a collar that fits around the drill steel and are "inhaled" through a connecting hose to a Le Roi DK280 dust collecting tank. For more information circle No. 43.

HOSSFELD ROCK DRILLING equipment is now being distributed by the Leo L. Hitchcock Manufacturing and Sales Co., 12015 Wicks St., Sun Valley, California. The exclusive sales representation of this well known line of prospecting drill equipment is for the area west of the Mississippi.

KREBS CYCLONES: A new 16-page, well illustrated brochure, fully describing the complete range of Krebs Cyclones is now available. Photographs, performance tables, and case history examples are given. Circle No. 42.

WALL CHART tells how to weld connections. Simplified procedures for making permanent electrical connections to any copper conductor or steel structure are described and pictured on a wall chart available without cost from Burndy Corp. It shows how to use the ThermOwel process for making a broad range of connections without an external power source. Circle No. 41.

CASTABLE RUBBER: An eight-page brochure describing in detail Goodyear Tire & Rubber Company's new development, Neothane castable polyurethane rubber, has recently been published. In the pure gum form, Neothane is harder than most conventional rubber compounds and has from two to four times the strength. The new product performs better than metals in applications requiring the combined properties of toughness, resilience and abrasion resistance. Circle No. 39.

DIPPER AND RIPPER TEETH: American Steel Foundries announces that Wear-pact steel dipper and ripper teeth are now cast by the Amer-Shell process, American Steel's refined version of shell molding. By this process hand grinding operations on teeth are eliminated assuring microdimensional tolerances. ASF's cap type tooth is reversible, and self sharpening. For more information circle No. 40.

NAGEL VERTICAL SHAFT PUMP is rigged for easy inspection. These vertical sump pumps are designed for rugged duty and constructed so that functional parts are within easy view of the inspector. Nagel also has available a handy pump selector. Send for your copy. Circle No. 47.

PRODUCTION AND MECHANICAL advantages of the new D9 series E Tractor and features of the new Power Shift transmission, are given in a new six page brochure released by Caterpillar Tractor Co. Circle No. 40.

A NEW 85 CFM ROTARY portable compressor has been announced by the Gardner-Denver Company. The most compact unit yet produced by the firm, the oil-air cooled Model RP85 compressor complements the company's line of portable compressors ranging up to 900 CFM capacity. The new model is especially designed for jobs requiring limited air output and maximum portability. For additional information circle No. 45.

36-INCH CRUSHER: Mechanical features of the 36-inch Hydrocone crusher are described in a new bulletin released by Allis-Chalmers. The four-foot 10-inches high crusher is available with instantaneous hydraulic adjustment for wear and product size. The crusher can be had with fine, intermediate or coarse crushing advantages. Circle No. 44.

THE MODEL 100 DUMPTOR, a ten-yard capacity off-road hauling unit, is the subject of a new bulletin now available from the Koehring Company. The bulletin features on-the-job views, component parts blow-ups, and drawings to illustrate and describe the machine's two-way controls, instantaneous gravity dump, and its ability to increase yardage hauled through its no turn operation. Circle No. 59.

TOURNATRACOR: A new 16-page, 4-color bulletin on the new 218 hp Model C Tournatractor is now available from the LeTourneau-Westinghouse Company. This attractive bulletin gives the whole story, including on-the-job photographs. Circle No. 52.

4-BLADE INSERT BITS, with blade sizes from 4 1/2" through 5 1/2", designed for heavy weight truck-mounted drilling equipment, is now available from the J. T. Williams Co. Designed for blast hole and prospect drilling, the bit features less strain on the drilling equipment, more gauge area in the hole and more cutting surfaces on the bottom of the hole. For further information circle No. 51.

FLYGT SUMP PUMPS: Available now from the Stanco Mfg. & Sales Co., is a new colored booklet describing in detail the operation of the Flygt pump. Various job applications are also cited. The Flygt submersible sump pumps are electrically powered and have no suction hose. Circle No. 33.

BIN LEVEL INDICATORS: The Bid-Dicator Co., has available for you a booklet describing their line of automatic bin level indicating devices. Many models are described for many different applications. Circle No. 22.

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CERAMOX V is a powerful ceramic magnet material incorporated in a new permanent magnetic pulley being offered by Dings Magnetic Separator Co. Used to promote fast and continuous separation of tramp iron from deep burdens, the new pulley is said to provide high magnetic strength across the entire width of conveyor belts and optimum removal efficiency at high operating speeds. For more information circle No. 37.

ST. PATRICK'S COPPER MINES, LTD., 4,000-ton per day mill in Erie, is described in detail in Denver Equipment Company's Engineering Notebook Bulletin No. M4-B102. In addition to the detailed flowsheet, metallurgical analysis, operating costs, and mill data are included. Circle No. 36.

A NEW AIR-POWERED HOIST by Joy Mfg. Co., offers a choice of several throttle and brake systems that make it adaptable for use in shafts for hoisting men and materials, car spotting, etc. The hoist has a lifting capacity ranging from 27,000 pounds at 37 feet per minute, to 3,700 at 220 feet per minute. For more details circle No. 35.

TURBOMIXER RDC column rotating disc mixer is described in detail in a new booklet published by the Turbo-Mixer Division of General American Transportation Co. The unit creates the proper environment for the transfer of one substance from one immiscible phase to another by passing the two phases in opposite directions while promoting intimate contact. Circle No. 24.

NEW EUCLID C-6 TRACTOR catalog is now available. Euclid Division of General Motors has just released a 24-page brochure on the Model C-6 Crawler. The booklet is well illustrated with photographs of job applications, sectional views and drawings. Circle No. 26.

ALL WEATHER OPERATION and other features of six models of rotary portable air compressors, ranging from 85 to 900 cfm, are described in the new Gardner-Denver Company bulletin, "Rotary Portable Compressors." Circle No. 32.

A NEW FLOCCULATING AGENT in granular form has been developed by Cyanamid International scientists. Known as Superfloc 16 flocculant, the product is particularly useful in thickening operations for increasing settling rates and overflow clarity. A high bulk-density product, Superfloc 16 in its essentially dust-free granular form makes it easy to feed, wet and dissolve. For further information circle No. 31.

LOG WASHER BULLETIN: A new 6-page bulletin on the McLanahan Mud-master Log Washer has been published by McLanahan & Stone Corp. This bulletin includes construction and design information as well as a dimensional drawing and parts list. Circle No. 30.

A-C PROCESS INDUSTRIES: Allis-Chalmers has related a catalog guide of equipment for the process industries. Pumps, valves, compressors, crushing and grinding equipment, mixing equipment and many other types of allied equipment are described. Featured also is electrical equipment for the complete process plant. Circle No. 29.

CONVEYOR IDLERS OF THE FUTURE is the title of a new brochure published by the Barber-Green Co. Three new series of belt conveyor idlers are described. Circle No. 28.

HOW FIVE WAY SAVINGS can be made in the continuous vacuum filtration of difficult slurries with the use of the Elmco belt continuous belt drum filter, is described in a new 12-page bulletin released by the Elmco Corporation. Circle No. 27.

MAINTENANCE CARTOONS: A series of clever 11" X 13" colored cartoons, pointing up the importance of preventive tractor maintenance, is offered free by the J. I. Case Co. to owners and operators of construction equipment. The cartoons are ideal for shop walls, bulletin boards, etc. Circle No. 21.

ORE, SAND AND GRAVEL handling is a new 16-page brochure by Sauerman Bros., Inc. Four pictorial sections show DragScraper and Cableway applications for excavating and hauling, storage and reclamation, engineering and construction. Circle No. 20.

WHITE SPRAY NOZZLES Save You Money, is the title of a new brochure released by the Deister Co. A simple, new spray nozzle as used on Deister Concemco Screens is described. Circle No. 19.

DOUBLE CENTER THEODOLITES with glass circles is the subject of an extensive brochure published by Geo-Optic Corp. The optical center theodolite with optical plummet on the telescope enable you to set up over or under a point optically. Circle No. 18.

SMALL MINE HOIST: A new pamphlet on semi-automatic hoisting practices for small mines describes the use of a new, low cost hoisting system for many underground applications, such as shaft hoisting, men and materials hoist, intermediate level hoist, raise-driving hoist, and many other underground applications. Manufactured by Vulcan Iron Works of Denver, the hoist features integral push-button control. Circle No. 17.

NEW FORMATION TYPE ROCK BIT to meet the immediate needs of blast hole drilling in mining operations where fast penetration rates are necessary, but where excessive gauge wear has been a problem, has been developed by engineers of the Varel Manufacturing Co. The new bit has been developed to provide drillers with increased footage and lower cost operation in abrasive formations of medium hard limestone or sandstone where gauge wear previously resulted in shorter bit life. For more information circle No. 38.

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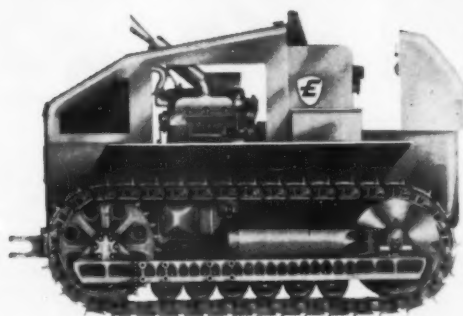
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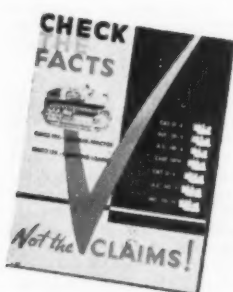
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Dr. Adolph Knopf, geologist and professor at Stanford University, Palo, California, has been awarded the Geological Society of America's Penrose Medal for his contributions to geology through his studies of the age of the earth, the origin of vein deposits, and the nature of volcanic rocks. Recipient of the Arthur L. Day Medal was **Sir Edward Bullard** of Cambridge, England, for his many significant contributions to geology through physics.

The Bunker Hill Company has announced that prior to appointment of a new president, **Emmett G. Solomon**, Bunker Hill vice president and director, will function as interim chief executive officer. **John D. Bradley**, Bunker Hill president, was killed in a San Francisco, California freeway accident on Thanksgiving night. Mr. Solomon has also been named chairman of the executive committee of the board of directors; director **Ross D. Leisk** has been appointed to the vacancy on the executive committee created by Mr. Bradley's death.

Leslie R. Vance, Bunker Hill Company design engineer, has assumed duties of mine maintenance superintendent at Kellogg, Idaho. He has worked with the St. Joseph Lead Company, the Idaho-Maryland Company, Hecla Mining Company, Clayton Silver Mines, and Day Mines, Inc.

Karl H. Koropp, superintendent of operations for the Garfield electrolytic refinery of Utah Copper Division, Kennecott Copper Corporation, has been named project engineer for western mining divisions of the corporation at Salt Lake City, Utah. **C. Arthur Zeldin** will succeed Mr. Koropp.

Bernard J. O'Neill, Jr., former resident geologist in charge of exploration in Pennsylvania and the middle Atlantic states for the New Jersey Zinc Company, has accepted a position as geologist in the Department of Earth Sciences at Stanford Research Institute, Menlo Park, California.

Thomas G. Ferguson has been elected president and chief executive officer of National Potash Company, New York. Mr. Ferguson joined National Potash as vice president and general manager when the company was formed in 1955. He has been in charge of the development and operation of the company's mine and refinery near Carlsbad, New Mexico. In his new capacity he will continue to make his headquarters in Carlsbad.

Dr. Donald H. McLaughlin, president of Homestake Mining Company, San Francisco, California, has been appointed to the 12-member advisory committee to the United States Atomic Energy Commission on its Plowshare Program for the investigation of peaceful uses of nuclear explosives. Dr. McLaughlin is the only mining representative on the committee.

Eugene B. Hotchkiss has been named executive vice president of Vitro Minerals Corporation, New York City, New York. A graduate of Michigan College of Mining Technology, Mr. Hotchkiss was executive vice president and director of New Enterprises, Inc., Boston, Massachusetts before joining Vitro in 1953.

Walter R. Shaw has been named project engineer, responsible for design, layout and process engineering on chemical and ore processing plants of the Western-Knapp Engineering Company. Prior to his employment with WKE, he was resident plant manager for the H. K. Porter Company, Inc.

Kenneth A. Phillips has been promoted to director of research and development for American Zinc, Lead and Smelting Company. Mr. Phillips joined American Zinc in 1942 and has served in various capacities in the metallurgical department; in his new position he will direct technical and metallurgical activities at all of the company's smelting, refining and pigment operations from his office in the Fairmont City division, East St. Louis, Illinois.

Dr. Hollis D. Hedberg, vice president, exploration, of Gulf Oil Corporation, has been elected president of the Geological Society of America. **Thomas B. Nolan** of the United States Geological Survey, Washington, D. C., has been elected vice president.

Eastern Oregon Mining and Mineral Association, Baker, Oregon has elected **Carl Suksdorf**, president; **Ward Hill**, vice president; **Jim Anderson**, secretary; and **Fred Moes**, treasurer.

Ernest E. Thurlow has been appointed chief mining geologist for the Northern Pacific Railway Company with headquarters at St. Paul, Minnesota. Mr. Thurlow has been a staff geologist for the United States Atomic Energy Commission at its offices in Montana, Washington, and Utah, and most recently was staff geologist for the Marcona Mining Company at its iron ore operations at San Juan, Peru.

J. W. Borskey, Jr. will fill a new position as manager, chemical operations for the Carlsbad, New Mexico plant of International Minerals & Chemical Corporation. He was employed by Duval Texas Sulphur Company in 1953 and associated with that company and its successor, Duval Sulphur and Potash Company, until 1957 when he left to join International.

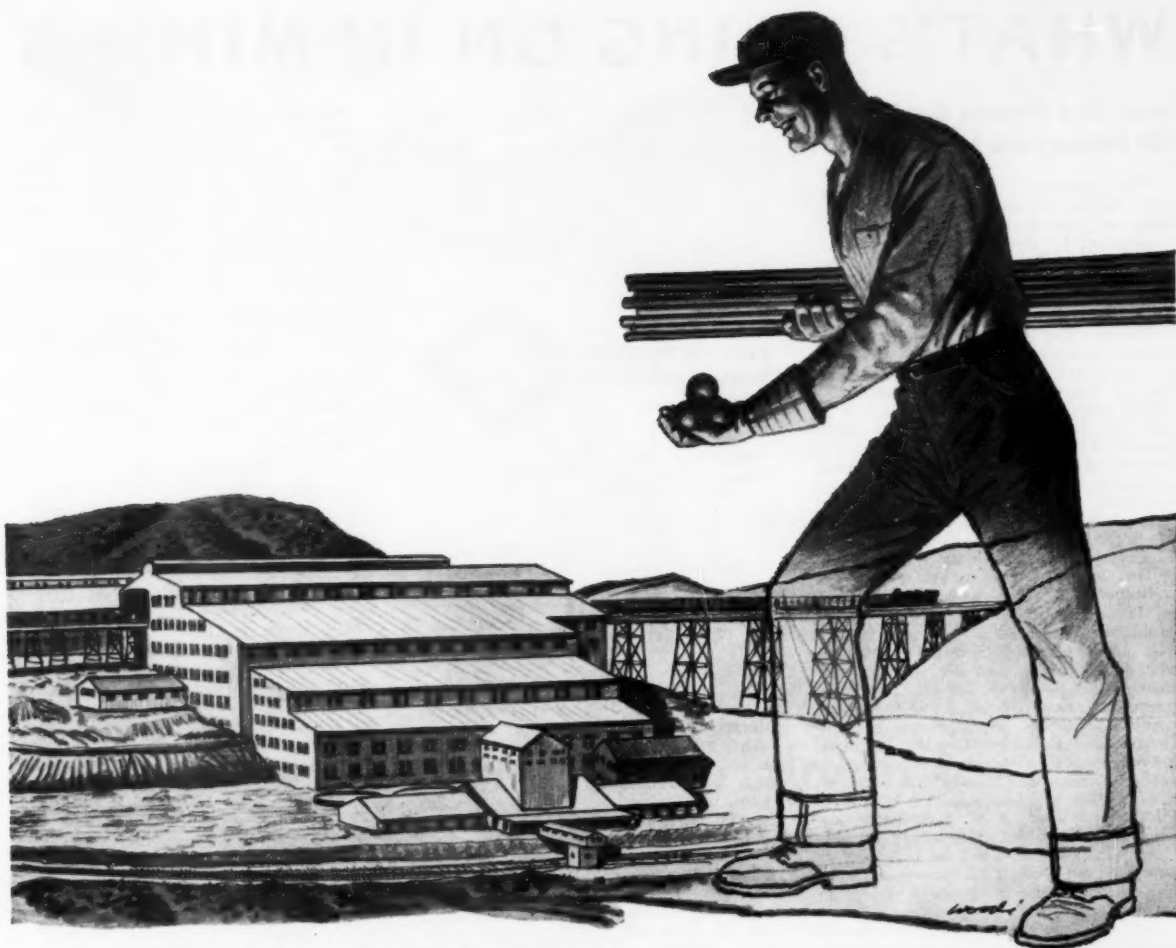
Robert J. Linney, executive vice president of the Reserve Mining Company, Silver Bay, Minnesota, has been awarded the Lawrence Saunders Gold Medal by the AIME. Mr. Linney will receive the Medal "For administrative leadership and aggressive determination in bringing into successful commercial operation mining and beneficiation of taconite iron ore."

Ira K. Hearn has resigned as assistant general manager of Utah Division of Kennecott Copper Corporation to become vice president in charge of operations of Celotex Corporation, Chicago, Illinois. Mr. Hearn joined the Tennessee Coal & Iron Division of U. S. Steel as a student engineer in 1937, and was with the Quebec Iron & Titanium Company in Canada from 1949 to 1958.

Recent promotions and assignments within the Freeport Sulphur Company's Louisiana division were: **Paul D. Bybee, Jr.**, as general superintendent of Grand Isle, **William S. Donner**, general superintendent of Grande Eclair; **S. J. Muery, Jr.**, general superintendent of Garden Island Bay; and **John E. Shaw, Jr.**, assistant general superintendent of Grand Isle.

Arthur Lyon, Salt Lake City, Utah oilman, has been named chairman of the board of United Western Minerals Corporation, Santa Fe, New Mexico, to succeed **Gen. Patrick J. Hurley (USA Ret.)** of Santa Fe. **Leland Thompson**, a Midland, Texas oilman, was elected president of the corporation to succeed **Alva A. Simpson Jr.**, Santa Fe.

Dr. Louis B. Slichter, director of the Institute of Geophysics at the University of California in Los Angeles, since 1947, has been named for the AIME 1959 Daniel C. Jackling Award, in recognition of "significant contribution to technical progress in the field of mining, geology and geophysics." Dr. Slichter received his Ph.D. in physics from the University of Wisconsin in 1922 and was later research assistant at the University. He has been a professor of Geophysics at Massachusetts Institute of Technology, and University of Wisconsin, and was a Rockefeller Research Fellow in 1946.



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WHAT'S GOING ON IN MINING

Iron Ore Picture Subject Of Minnesota Meetings

The University of Minnesota's Twenty-First Annual Mining Symposium will be held on January 12 and 13 at Duluth. Conducted by the School of Mines and Metallurgy and the Center for Continuation Study, the Symposium's theme will be Lake Superior Iron Ores and the American Economy.

For the first time, the program of the annual meeting of the Minnesota Section of the AIME has been integrated with that of the University Symposium. The AIME sessions will be held on January 11 and will present the basic overall background in economics for the more specific sessions of the Symposium, with special reference to iron and steel. Dr. L. C. Michelson, consultant to Republic Steel Corporation, and formerly director of Management Services at the University of Chicago, is responsible for the program.

This year's Symposium was designed to combine the practical with the theoretical in discussing the industry's most timely problems—economics and competition in iron mining. Among the papers to be presented are these: Iron ore reserves and their market potentials, Robert Lloyd, vice president, raw materials, U.S. Steel Corporation; Current developments in New Quebec and Labrador, Gordon A. Gross, mineral deposit division, Geological Survey of Canada at Ottawa; The competitive position of Lake Superior iron ores, John S. Wilbur, vice president—sales, Cleveland-Cliffs Iron Company; Desirable characteristics of iron ore for furnace use, panel led by Dwight C. Brown, assistant director of research, Jones & Laughlin Steel Corporation; Iron and steel vs. substitutes, Bay Estes, Jr., vice president—marketing, U.S. Steel Corporation; Automation and new processes, John D. Sul-

livan, Battelle Memorial Institute; General economic summary, R. W. Whitney, vice president—operations, Hanna Mining Company.

As usual, registrations for the Symposium should be made in advance. Inquiries should be sent to the Director, Center for Continuation Study, University of Minnesota, Minneapolis 14.

CENTRAL STATES



American Zinc, Lead and Smelting Company estimates its total expenditures for mine development and normal improvement program will require from \$2,000,000 to \$2,500,000 per year. The company is preparing to develop its new Immel mine at its East Tennessee properties where it will sink a 1,000-foot vertical shaft. In addition to capital expenditures for mine property, the company will continue its mechanization of surface plants and building improvements.

The Metals and Minerals Division of Metal & Thermo Corporation is undertaking expansion of its mining operations in Hanover County, Virginia. The company has been mining rutile and ilmenite there, but has now determined that commercial quantities of apatite, mica, and sphene are also present. In an initial move to capitalize on these other associated minerals, the company is installing additional equipment in existing ore processing facilities at Hanover so that apatite may be produced, too. The company expects production by the middle of this year.

American Zinc, Lead and Smelting Company is continuing its drilling program in the Bourbon area of Missouri. Recent tests were made on the Reverend Smith property by Sprague and Henwood for the mining firm. Earlier in the year, some showings of copper were found in core holes in the Bourbon-Boss-Bixby district, although the firm has been seeking iron ore.

The Eagle-Picher Company has received the approval of the Indian Bureau Director of the Muskogee, Oklahoma area office for reduction of lead and zinc royalties of Quapaw Indians. Tribesmen in the area have been contracted by the Bureau. The proposed cut is a move toward reopening of the mines in the area which have been shut down for about two years. The mining firm has been paying a royalty of 12.5 percent, but says it cannot continue the payments because of the low grade of the ores and the depressed prices for base metals. Eagle-Picher has proposed a new sliding scale royalty plus a basic \$2.00 per acre annual rental.

The Burnside Bulk Marine Terminal 30 miles from Baton Rouge, Louisiana has been shipping foreign iron ore to steel mills of Chicago and St. Louis, and is expected to become a key iron ore terminal in the future. Before the steel strike, about 20,000 tons of iron ore were passing through this point weekly. The Terminal has only been open about one year. It was built originally to serve the ships carrying bauxite to the adjacent Ormet Corporation alumina plant, but the facility's design is for all types of bulk material. Including clean-up time, the terminal can handle an average of 900 to 1,000 tons an hour.

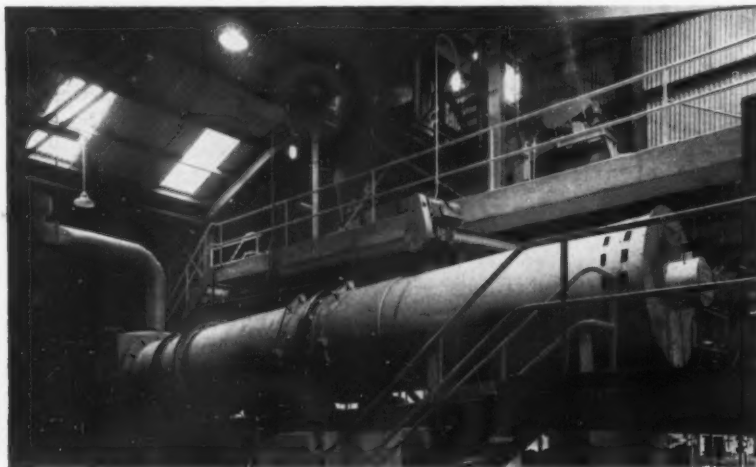
EASTERN STATES



Kennecott Copper Corporation's new \$30,000,000 electrolytic refinery near Baltimore, Maryland is nearing completion. Limited production of electrolytic copper is being produced. Ultimate monthly capacity will be 16,500 tons.

Freeport Sulphur Company has closed its Bay Ste. Elaine sulphur operation, 30 miles south of Houma, Louisiana. Plans to begin production at Lake Peltó, five miles from Ste. Elaine, have been deferred temporarily because the company's present output is exceeding demand. The mining barge and other equipment at Ste. Elaine are being transferred to Lake Peltó on a standby basis. Bay Ste. Elaine began production in November 1952, and produced approximately 1,113,000 tons of brimstone as of November 1, 1959. Though not a major property, it proved to be a commercial venture, and also served as a test project for developing the company's unique use of sea water in mining sulphur.

Formal action by the Bartow, Florida city commissioners has cleared the way for Armour Agricultural Chemical Company to mine for phosphate within the



Nickel Refinery To Use Standard Dryers

Freeport Nickel Company has installed this 5- by 24-foot Standard Hersey parallel flow, direct-fired rotary dryer in its new refinery at Port Nickel, Louisiana. The dryer will dry nickel powder at a feed rate of nearly 10 tons per hour wet basis. A 6- by 40-foot rotary dryer will be used to dry ammonium sulfate at a feed rate of more than 12 tons per hour wet basis. The refinery, due to go on stream shortly, is expected to become a United States leader in nickel and cobalt production, as well as ammonium sulfate. The Standard Steel Corporation of Los Angeles designed and manufactured both of the dryers.



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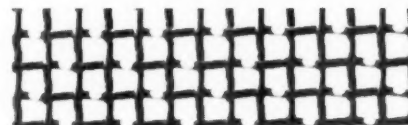


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city limits. Two changes were made in the ordinances governing mining within city limits: the regulation demanding that the reclaimed land be able to withstand a pressure of 3,000 pounds, was amended to 1,700 pounds which reportedly meets FHA specifications for housing; the total time for mining and reclamation was extended from three to five years. The area was also rezoned as M-1 for mining.

Aluminum Company of America has decided to partially resume construction of its \$80,000,000 aluminum smelter at Warrick, Indiana. Ground for the plant had first been broken in July 1956, and smelter production was to have started in 1957. However, construction was gradually slowed and then finally suspended as the recession cut demand for primary aluminum. It was originally planned for four potlines with a total smelting capacity of 150,000 tons. The firm still has made no definite decision about resuming production, but since the construction will take some time, the firm has decided to proceed with some building phases.

The Instrument Society of America has received a grant from the National Science Foundation to continue the translation and publication of the 1959 issues of English editions of four leading Russian technical journals. The ISA "Soviet Instrumentation and Control Translation Series" is now in its third year.

Copper Range Company has acquired a substantial interest in The Alloy Corporation of Watertown, Massachusetts. The latter is a metals and materials research and development firm which was organized in 1955 by a group of scientists from the Massachusetts Institute of Technology. The firm will continue under its original management. Copper Range's subsidiary, White Pine Copper Company, operates a large copper mine at White Pine, Michigan.

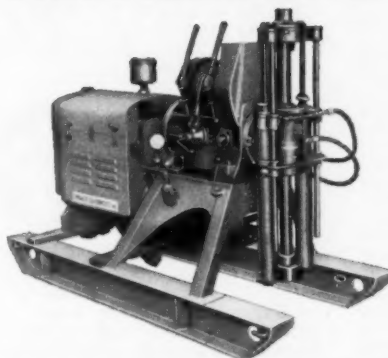
Accurate Specialties Company Inc. has formed a subsidiary, High Purity Metals Inc. of Hackensack, New Jersey, to specialize in production of ultra high purity raw materials, such as indium, gallium, aluminum, tin, lead, and germanium, for use in the electronics industry. Facilities will include a complete refining plant and an analytical laboratory.

The Carborundum Company of Niagara Falls, New York, and Harbison-Walker Refractories Company of Pittsburgh, Pennsylvania have formed Harbison-Carborundum Corporation. The two firms will pool their refractories technology and financial resources to establish a jointly owned subsidiary for the engineering, manufacture, and sale of fused refractories. The fused refractory lines will include alumina, chromite, and zirconia base refractories.

Aluminum production operations have been reduced to 80 percent of installed capacity by Reynolds Metals Company. This brings the firm's production rate to about 560,000 tons, since its available capacity is rated at 701,000 tons of primary metal per year.

The chemical and metallurgical operations of Vitro Corporation of America and its subsidiaries have been consolidated under a new firm called Vitro Chemical Company. This includes those

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operations of Vitro Uranium Company, Heavy Minerals Company, and Vitro Rare Metals Company. The new chemical company is presently engaged in the milling of uranium ores; production of thorium, rare earth chemicals, rare metals and metal alloys, and industrial chemicals and is also engaged in chemical and metallurgical research and development.

A \$500,000 expansion is underway at International Minerals and Chemical Corporation's phosphate plant at Wales, Tennessee. Completion is expected early in 1960. Equipment is being installed to improve recovery of waste products, and to increase production capacity of tricalcium phosphate. Dunn Brothers of Columbia, Tennessee have the contract for the work.

Aluminum Company of America has revealed its master plan for a multi-million dollar research and development center which will be built over the next few years on a 2,400-acre tract at Merwin, Pennsylvania, 28 miles east of Pittsburgh. Foundation test borings are already underway, along with an analysis of the soil, to determine best building sites. Ground breaking for the first installation is to be started within a year.

The General Services Administration has awarded a one-year broker contract to Real Estate Management, Inc. of Chattanooga, Tennessee for sale of the Cramet titanium plant. The

plant was built in 1953 by Cramet Inc. to produce 6,000 tons of titanium sponge annually. It has been surplus to the government's needs since mid-1958. Located on a 127-acre site, it includes 17 buildings.

Some 700 acres of abandoned phosphate land in Polk County, Florida have been purchased by Tampa Electric Company and Florida Power Corporation as the site for a proposed nuclear power plant. The property is three miles east of Ft. Pierce and is close to transmission lines of both companies. Target date of plant operation is June 1963.

IRON RANGES



Pickands Mather & Co. will start construction of two crushing and screening plants this winter on the Gogebic Range of Upper Michigan. The project is part of a program aimed at upgrading ore from the Gogebic to make it more competitive. The plants will be built at the Newport and Geneva mines near Ironwood. Concrete work is being done by P. J. Nickel Company under contract.

Lake Shore Inc. has a contract to supply 35 conveyor units for the new Humboldt Mining Company 2,000-ton-per-day

pelletizing plant being built 26 miles west of Marquette, Michigan. The heavy-duty conveyor systems will be 850 feet long, and will use 1,852 feet of belting. The contract also includes all necessary conveyor pulley, coupling and control equipment.

Bad weather and below freezing temperatures hampered November shipments of iron ore from U.S. Great Lakes ports despite an all-out effort to build up steel mill stocks. Still, 5,065,942 tons of iron ore and concentrates and taconite pellets were shipped during the month, compared with 4,281,562 in November 1958. Season total as of December 1 was 39,541,448, compared with 50,610,774 in 1958. Erie Mining Company shipped 2,670,389 tons of taconite pellets for the entire season (through Taconite Harbor) and Reserve Mining Company shipped 4,994,174 tons (through Silver Bay). Reserve also set a new loading record in a 24-hour period on Nov. 21-22 when a total 72,400 tons of stockpiled pellets were loaded in seven vessels.

Pickands Mather & Co.'s Mather "A" and "B" shafts are now connected on the 5th, 6th, 7th, 8th, 9th, and 10th levels. The 10th level was connected after driving 9,600 feet of drift. It required careful and painstaking surveying and engineering to insure exact meeting of the two drifts being driven thousands of feet underground. The 10th level connection was "on the nose." This work was completed June 30th just before the strike, and not much has been done since.

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ALASKA



Hyder Mines has prepared a 100-ton shipment of high-grade lead-silver-copper-gold ore for shipment from its **Riverside** property in Alaska to the **Bunker Hill** smelter at Kellogg, Idaho. A 50-ton mill on the property will be reactivated when sufficient ore is developed. Carl C. Wikstrom is superintendent.

The advent of winter weather has brought an end to the 1959 mining season in Alaska and many operators are leaving the area until spring. Among them, Mr. and Mrs. Mannie Olson and Andy Anderson have shutdown their Fish Creek gold mining operations and are spending the winter in Seattle. Hugh Mathison Sr. and his son, who had been gold mining on Big Creek in the Chandalar area, have gone south for the winter.

United States Smelting Refining and Mining Company has completed its work for the season. During the year the firm moved the Pedro Creek Dredge No. 4 to Chicken Creek in the Fortymile area. Dredge No. 2, which had been sunk during the spring because of ice blasting, was repaired and in operation before the season ended. Dredge No. 8 on Engineer Creek and Dredge No. 5 on Dome Creek finished the season and may be out of commission entirely because of mined out ground.

IDAHO



The **Bunker Hill Company** is returning its Electrolytic Zinc Plant near Kellogg, Shoshone County, Idaho to capacity operation with reactivation of Unit No. 5 which was shut down in January 1958, because of a low price for zinc. The move was scheduled to increase annual production from 60,000 to 74,000 tons. Construction of the firm's \$2,000,000 phosphoric acid plant is well underway and is scheduled to go into production by July.

Steel shaft sets are being used for the first time in the Coeur d'Alene mining region of Shoshone County, Idaho. **American Smelting and Refining Company** is installing them in the new No. 3 ventilation shaft at the **Galena** mine in the silver belt west of Wallace. A silver-bearing vein has been intersected in exploratory work northwest of the main shaft at the 3,000-foot level. It is north of the Polaris fault. The mine's main silver vein now has been opened to a depth of 4,000 feet. The property is operated under long-term lease from **Callahan Mining Company**.

Samson Oil and Mineral Company of Fort Worth, Texas has acquired control of **Silver Star-Queens Mines, Inc.**, which has been developing properties in the

Hailey-Bellevue area of Blaine County, Idaho. The new management proposes to continue the search for the extension of the Minnie Moore oreshoot, but has alternative programs in mind. Joe A. Foster of Fort Worth is president of both firms, and T. O. Briggs, Fort Worth, secretary-treasurer. Ralph H. Thurston, Lander, Wyoming, is consulting mining geologist in charge of operations.

American Smelting and Refining Company is repairing the main shaft at the old **Morning** mine at Mullan, Coeur d'Alene mining region, Shoshone County, Idaho. The work has progressed to a point more than 100 feet below the 1250 level.

Idaho Goldfields, Inc. has let a contract to Jack Lowery of Hayden Lake, Idaho, to drive a short crosscut at its property near the summit of Fourth of July Canyon in Kootenai County. The crosscut will be driven from the recently reopened Deadman's Tunnel in which an early-day gold miner's skeleton was found some years ago.

Exploratory diamond drilling of **Midvale Mining Company's** property in the Mullan-Burke area, Shoshone County, Idaho, is called for in an agreement with W. J. Logus, president of **Vindicator Silver-Lead Mining Company**. R. H. Bailey is president of Midvale.

Rare Metals Corporation of America, a subsidiary of **El Paso Natural Gas Company**, has entered into a contract with **Agency Creek Thorium and Rare Metals Corporation** of Salmon, Idaho for exploration, development, and mining of thorium and rare metals on Agency Creek property. The property consists of 78 claims in Lemhi County, Idaho and four

claims in Beaverhead County, Montana. Metallurgical work will begin soon, but activity at the property will have to wait for spring.

Sunshine Mining Company has established a market for antimony being produced in granular form at its silver mine in Shoshone County, Idaho's Coeur d'Alene mining region. Sales and shipments are being made to manufacturers of arsenical-antimonial-lead products. During the first nine months of 1959 the company milled 175,514 tons of ore and produced 4,655,756 ounces of silver, 2,152,042 pounds of lead, 1,706,018 pounds of copper and 1,296,035 pounds of antimony.

Operations have been resumed in the **Center Star** mine, eight miles east of Golden, Idaho, owned by Mrs. M. F. Ward of Lewiston. A crew are cleaning adits, and repairing timbers and machinery in the old gold mine which has been inactive since World War II. Harold C. Lynch is manager.

Approximately 200,000 cubic yards of overburden has been stripped from clay and silica deposits near Bovill, Latah County, Idaho, by **J. R. Simplot Company** of Boise. Stripping is to a maximum depth of 20 feet. A new 500-ton mill is scheduled to start production in January. Laboratory and office buildings have been completed and a shop building was nearing completion at last report. P. T. Peterson is resident manager.

Gem State Consolidated Mines, Inc., operating a gold mine at the old **Camp of Pearl** (20 miles northwest of Boise), has completed a 40-ton jig-flotation mill. This new mill replaces a 15-ton mill-table plant, and includes a Hardinge ball mill, Dorr rake classifier, and a Denver flota-



Helicopters Save Valuable Time in Alaska

Once more helicopters have proven their worth as an aid to prospecting. This past summer, **Moneta Porcupine Mines Ltd.** of Canada contracted for use of a **Hiller 12-E** helicopter, a model of the U.S. Army's H-23-D Raven, to transport equipment and men to the location of a new exploration mine shaft at a 4,100-foot-high site in the mountains of southern Alaska. An exploration team also depended on this craft to taxi three two-man crews with 150-pound portable drills along their grids, leapfrogging along the traverses over the 5,000-foot mountainous plateaus. Each team carried exploration and survival equipment and food totaling 500 pounds.

tion machine. The building housing the old plant has been expanded to meet the requirements of the new equipment. Drifting west on the Gem vein for the last 60 feet has been in a pay chute assaying between 10 and 22 ounces gold per ton over an average width of six feet. The officers of the company include Trevor R. Baugh as president and George E. McKenney as superintendent. Ernest Oberbillig is the mining and metallurgical consultant.

A block of gold-bearing ore sufficient for two years' operation of the company's 100-ton flotation mill has been opened by **Kimberley Gold Mines, Inc.**, 40 miles east of Riggins, Idaho County, Idaho. An ore-shoot said to be more than 300 feet long has been opened by initial development work. Milling is expected to get underway next spring; also development work at the firm's **Hinkson-Bishop** properties. Oak T. Otness of Tacoma, Washington, is company president.

A vein of direct shipping grade lead-silver ore has been opened on the **Le-Grande** group of six mining claims seven miles northwest of Hailey, Blaine County, Idaho. The discovery was made by William Uhrig with a tractor. A shipment has been prepared. The claims are owned by Floyd Wilson and Martin Curran.

A 40-foot Quonset hut has been built by **Clearwater Mines, Inc.** at its copper-gold-silver property on Niagara Creek, southeastern Shoshone County, Idaho, to serve as a machine shop and garage. E. I. Fisher of Spokane is secretary-treasurer.

MONTANA



The **Calvert tungsten** mine in Beaverhead County, Montana has been reopened by **Minerals Engineering Company** on a limited basis with production scheduled to be resumed early in January. Plans call for initial treatment of about 5,000 tons of ore monthly at the Glen mill to supply current needs of the firm's Salt Lake City plant which has been making ammonium para-tungstate for industry.

A two-compartment vertical shaft being sunk at the **Nancy Lee** mine near Superior, Mineral County, Montana is approaching the 200-foot initial objective. Crosscutting then will be undertaken to reach a silver-lead ore body indicated by diamond drilling. The property is owned by **Nancy Lee Mines, Inc.** of Kellogg, Idaho.

Bear Creek Mining Company has relinquished the more than 100 mining claims it had staked in Granite County, Montana, near Philipsburg. (See **MINING WORLD**, December 1959, page 44.) The claims were staked in order to hold the ground for further testing. The testing was discouraging, however, and the claims were dropped.

C. G. Miller of Dillon, Montana, has sold his **New Departure** silver mine and **Bannack** gold mine southwest of Bannack, Beaverhead County, to **Spokane National Mines, Inc.** of Spokane, Washington. The purchaser is modernizing a cyanide mill at the gold mine to handle 100 tons of ore daily, and plans to install a 150-ton flotation mill at the silver mine. Mine and mill crews will total about 16 men, with E. H. Brooks of Spokane as mill superintendent. The Bannack district was the scene of Montana's first placer gold discovery nearly 100 years ago, and has yielded a reported \$15,000,000 worth of gold. It has been virtually inactive in recent years. The **New Departure** has a recorded production of \$3,500,000 worth of direct-shipping ore. George Allison, Spokane and Casper, Wyoming, is president of **Spokane National**.

A new mining firm has been incorporated in Bozeman, Montana. **Easton-Pacific and Riverside Mining Company** has been organized with Pierce L. Olson of Sauk Rapids, Minnesota, Perry Blakely of Virginia City, Montana, and Allen L. McAlear of Bozeman, as directors.

Vern Moulton of Shelby, Montana, and associates plan to resume gold mining operations in the Sweetgrass Hills near Gold Butte. Enough gold has been discovered by prospecting to make commercial recovery feasible, they say.

Claims 12 miles northwest of Libby, Lincoln County, Montana, are being explored by Harvey and Harry Johnson, Kass Kimberlin, and Bill Freidle of Yak-

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ima, Washington. They have uncovered a highly mineralized quartz vein.

In doing its annual assessment work near Basin, Montana, **Sylvan Gold Mines, Inc.** installed a two-drill compressor and extended its main tunnel to within an estimated 80 feet of an ore shoot mined at a higher elevation. Harve H. Phipps, Spokane attorney, is a principal owner.

OREGON

Wah Chang Corporation's new electron-beam furnace near Albany, Oregon is producing five tons of columbium, tantalum, zirconium, and hafnium monthly, and a second furnace has been ordered from **Stauffer-Temeskal Company** Richmond, California.

In the Bourne area of Baker County, Oregon, several truckloads of gold-silver concentrates have been made from ore mined at the property of **Cracker Creek Mining Company** of Minneapolis, Minnesota. Shipments have gone to the Trail, British Columbia, smelter. The property is under sub-lease by Dave French, manager of **Bourne Mines, Inc.**, from Ward Hill of Baker. Lloyd Anderson of Sumpter is mill superintendent. Byrl Fowler, formerly of Republic, Washington, owns the hauling and bulldozing equipment being used and operates the crushing plant.

Lakeview Mining Company received a certificate from the Office of Civil and Defense Mobilization permitting rapid amortization on 80 percent of the \$3,021,800 cost of its uranium ore processing plant at Lakeview, Oregon.

Gold-silver ore is being mined by **Cobalt Gold Mines, Inc.**, on Dixie Creek, near Prairie City, Oregon. Ore is trucked 7½ miles to John Day for treatment in the former chromite concentrator of **Tri-County Milling Company**. Ben Bailey of Prairie City is in charge of mining and milling operations. Henry Stevens of Boise, Idaho is president of Cobalt Gold, and Joe Lane of Ontario, Oregon is secretary.

"Lode Mines of the Central Part of the Granite Mining District, Grant County, Oregon," has just been published by the **State of Oregon Department of Geology and Mineral Industries** as Bulletin 49. George S. Koch, Jr., Assistant Professor of Geology at Oregon State College, is the author. Since its discovery in 1861, the Granite mining district has been one of the State's leading producers of gold and silver from lode mines. The **Buffalo mine**, largest producer in the district, is one of the few gold mines in the United States that was able to reopen after Government closure in 1942 and continue to operate to the present day. In Bulletin 49, Dr. Koch has described the operation of the Buffalo mine and has presented the available information on the underground workings of eight other mines in the district. Included in the Bulletin are descriptions of the mineral deposits and the geology of the area. A discussion on rock

alteration at the Buffalo mine by S. H. Filcher is appended. Bulletin 49 is paper bound, has 49 pages, numerous mine maps and sections, photographs, and a geologic map. It may be obtained from the Department offices in Portland, Baker, and Grants Pass for \$1.00.

WASHINGTON

Representatives of two Japanese firms, **Nittetsu Mining Company** and **Mitsui Steamship Company**, have been negotiating with owners of the old Buckhorn Mountain iron mine northwest of Republic in Okanogan County, Washington. An upgrading plant is reported under consideration. John Citkovich, Colville, is one of the mine's principal owners.

Northwest Magnesite Company is employing about 200 men at its quarries and kilns at Chewelah, Stevens County, Washington in making dead-burned magnesite for steel mills and foundries.

Gold production at the Ferry County, Washington operations of **Knob Hill Mines** has been going directly to the United States mint at San Francisco during the Tacoma, Washington smelter strike. A. R. Petterson is resident manager.

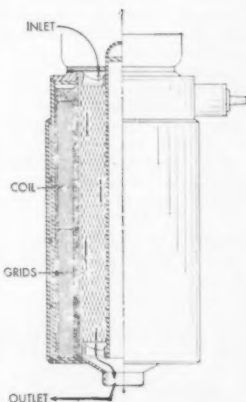
Spokane National Mines, Inc. is planning an early resumption of drilling on leased ground adjoining the **Midnite uranium mine** in the Spokane Indian Reservation, Stevens County, Washington. At one of its leases in the Mount Spokane District in Spokane County, the firm has been stock-piling uranium ore for shipment to the processing plant at Ford.

Open-pit iron ore mining operations at the old **Big Iron mine** in the Orient district of Stevens County, Washington are planned for next spring by Dean Koethke of Kellogg, Idaho. He has taken up a lease option on the property last operated in the 1930s. Dewey J. Murrow of Spokane is president of **Big Iron Mining Company**.

Hecla Mining Company has purchased the **Ace Sand & Gravel Company** of Spokane, Washington for about \$600,000. It will be operated by a wholly owned subsidiary of Hecla, **Ace Concrete Company**. Former owners were Mr. and Mrs. Lloyd Borjessan. James H. Hunter will be general manager of sand and gravel operations.

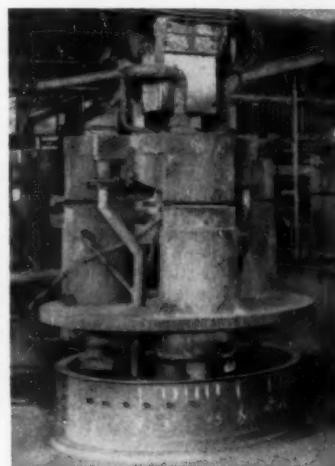
The Marble, Washington dolomite quarry in northern Stevens county, buildings and machinery, have been purchased by **Frank G. Baulne, Inc.**, Spokane road construction firm, from the Federal government for \$68,500. Production went to the government magnesium plant at Mead, Washington in World War II.

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COLORADO

A new Swedish Alimak raise climber is being installed in the **Shenandoah** mine of **Shenandoah Limited** near Silverton, Colorado. The machine has a capacity of 400 to 500 feet and will be used to drive the raise to connect the main haulage level in the **Silver Lake** with the **Unity Tunnel**, thereby giving access to the Letter G vein in the Unity. The new sampling plant is under construction near the Shenandoah mill and should be in operation early next summer, or as soon as adequate ore stockpiles justify its operation. Russ Wood, assistant general manager of **Standard Uranium Company** which is developing the property, invited all residents of Silverton to an "open house" at Gladstone in December to view the installations at the American Tunnel portal.

Idarado Mining Company was able to return to a five-day work week late in November at its Telluride, Ouray, and Silverton, Colorado operations. The firm had been on a four-day week since October 9 because of impending steel shortages caused by the nation-wide steel strike. The five-day week was expected to continue as long as the firm could maintain adequate steel supplies.

Beaver Mesa Uranium Inc. mined and sold a total of 71,567 tons of ore assaying an average of 0.25 percent U_3O_8 and 0.92 percent V_2O_5 last year which was an increase of 5,084 tons over the preceding year's operation. The company's present rate of production is 5,000 tons of ore per month, which is a reduction in previous monthly tonnage. The company reports this is in keeping with its market, and so it is reducing its mining operations and working force in certain areas. The firm has surrendered its lease with **New Idria Mining and Chemical Company** in exchange for a right-of-way through certain property controlled by New Idria. This right-of-way will enable Beaver Mesa to mine additional company controlled property more economically. Also, it will no longer be necessary for Beaver Mesa to mine high royalty (45 percent) property of New Idria at a loss.

UTAH

Utah Construction and Mining Company will prospect for iron ore in the Brighton area east of Salt Lake City, Utah, over the next few years. A lease and option agreement with **Great Western Mines Inc.** and **Miller Hill Mining Company** gives Utah an opportunity to mine by open pit if prospecting and geological evaluations indicate any ore of value in the property. **Great Western** holds 116 patented claims and **Miller Hill** has 33 patented claims.

Utah Copper Division of Kennecott Copper Corporation paid \$9,769,833.92 in property taxes to the state of Utah for 1959. Despite the huge sum, it was \$39,614.13 less than the firm paid a year ago. The 1958 tax bill was the largest single payment to be made in the history of the state. This year's decrease was due primarily to a drop in property valuation of the huge ore body in Bingham Canyon. Property valuations on ore bodies in Utah are based on net proceeds of the three previous years, and these were down for the years 1956 to 1958.

The first major harvest from the new salt ponds of **Solar Malt Company** started late in 1959. It had taken about three years to lay the 18-inch hard salt foundation for the ponds which, together with a new plant, represent an investment of about \$1,000,000 for **Pennsalt Chemicals Corporation** and **Hooker Chemical Company**, joint owners of Solar Salt. The facilities are located between Grantville and Stansbury Island, Utah. The 10 ponds have a total capacity of between 160,000 and 200,000 tons of salt annually (depending upon evaporation conditions).

The AEC plant at Monticello, Utah, operated by **National Lead Company** closed down January 1. The mill will be kept in standby condition for about two years before being offered for sale by the government.

The **American Mineral Resources Association** has been organized in Salt Lake City, Utah, to promote the welfare of all industries involved in mining, oil and gas, water conservation, and public lands. John Moore Williams is president and general manager of the association. Other officers include: Duane C. Randall, first vice president; Irwin C. Glaser, second vice president; Robert Carlson, third vice president; and Wendel T. Hackett, fourth vice president.

Calera Mining Company has permanently closed its Garfield, Utah refining plant which had been producing cobalt for the past eight years. Abandonment of the project was caused by GSA not renewing its buying contract for cobalt. The plant and equipment have been put up for competitive bidding.

Utah Salt Company has completed construction of its \$250,000 plant near Wendover, Utah. The firm will harvest, process, and sell salt from the ponds of **Bonneville Ltd.**, also near Wendover, where Bonneville recovers potash in a solar evaporation process.

The **University of Utah College of Mines and Mineral Industries** reports the discovery of new mineral in the state which it has named eardleyite in honor of Dr. Armand J. Eardley, dean of the mining college and professor of geology. The mineral is believed to be similar to hydrotalcite, but a new species which is a nickel-zinc analogue. The mineral was found in Wells Canyon in the southern Oquirrh Mountains. This is said to be the first occurrence of nickel in the state. The nickel content is small, however.

Four Corners Oil & Minerals Company of Denver, Colorado has leased its mine No. 8, the **Monogram**, at Green River,

Utah to **E. E. Lewis, Inc.** The property had been shut down since February. Additional development drilling will be required to further outline known ore bodies on the property.

The phosphate committee of the **Utah State Land Board** is seeking phosphate in the Hogup Mountain area in western Box Elder County. Chairman is Dr. J. Stewart Williams, dean of the graduate school at Utah University. David Crockett is working with him in the sampling project. Preliminary investigations have shown the presence of phosphatic shale.

The Mining Chemicals operation of **American Cyanamid Company** have been moved to Salt Lake City, Utah from Oakland, California. The firm's Western Regional Office is in Salt Lake. O. R. Brown is western regional manager of the explosives and mining chemicals department.

SOUTH DAKOTA

The **Atomic Energy Commission** has granted **Mines Development Inc.**'s request for a hearing this month in connection with the apparent violations of Commission radiation safety regulations in operations of its uranium processing mill at Edgemont, South Dakota. The matters to be considered are: whether the company failed to conduct surveys in mill areas occupied by employees to determine concentrations of airborne radioactivity; whether the company failed to conduct adequate surveys in mill areas occupied by employees to determine external radiation levels; whether a Commission order of November 2, 1959 directing the company to take prompt steps to come into full compliance with Commission radiation safety regulations with respect to operation of its mill should be sustained.

WYOMING

Development work is continuing on the **Green Mountain Uranium Corporation** property in Crooks Gap, Wyoming. More than 1,500 feet of underground development work has been completed and more will be done before extensive mining is undertaken. Initial work was performed under contract by **Quad Construction Company**, but the firm is doing its work now. The **Green Mountain** is one of the major properties in this area; it is operated as a **Phelps Dodge Corporation** subsidiary. At the nearby **Continental Uranium** property, steady production continues from its underground workings. First phase of an underground program at the **Harrower Brothers-Heald** property south of Continental and Green River was completed by **Lucky Mc Uranium Corporation** before closing down for the winter.

Rio De Oro Host to Russian Group in Uranium Tour

Four Russian visitors, headed by Professor Vasily Emelyanov, Soviet Chief of Atomic Energy, toured Hidden Splendor Mining Company's Rio De Oro Dysart No. 1 mine in the Ambrosia Lake district of New Mexico late last year. The visit was arranged by the U.S. State Department and the AEC. Accompanying the Russians were Senator Clinton P. Anderson, chairman of the Joint Committee on Atomic Energy, Jesse Johnson, chief of the Raw Materials Branch of the AEC, Elton Youngberg, assistant manager of the Grand Junction Operations Office, Eugene Crutt, chief of the Grants branch of AEC, and other AEC officials. Floyd B. Odum, chairman of the board of Atlas Corporation, Edward Farley, vice president of Atlas, and Rodney DeVilliers, president of Rio De Oro, were present.

The Russians were told that the Dysart No. 1 mine is producing 30,000 to 35,000 tons of uranium ore per month, working two 8-hour shifts per day, and a six-day week; and that the ore body extended completely across Section 11 and contained about five pounds of U_3O_8 per ton. They seemed well impressed with these figures and stated that their ore bodies were not as continuous. None of the Russians were mining men, although they did ask general questions about sampling of ore, exploration drilling techniques, and control of radon gas.

The photograph shows Prof. Emelyanov, A. A. Bocharov, and G. L. Konstantinov of the Soviet party in a jeep underground, accompanied by Ray Schultze, vice president and manager of Rio De Oro, and Richard Perron, jeep driver. Mr. Odum is standing by the jeep.



ARIZONA

Banner Mining Company and Pima Mining Company have agreed on development of the ore body which is located on both properties, separated only by a common boundary line. Pima has open pitted part of this up to the boundary line. Under the agreement, which ends a long period of litigation, Pima will mine the Banner ore for the Banner account at cost of operation. There will be a period of extensive stripping before open-pit mining can be started. The agreement is for nine years, at the end of which it is assumed that Banner's ore will be mined out. Banner estimates that it has about 1,800,000 tons of ore in this area, averaging about 1.6 percent copper. In another area of its Twin Buttes property south of Tucson, Arizona, Banner is continuing to sink its \$1,000,000, five-compartment shaft to develop high-grade ore in the Eisenhower group discovered by drilling near its Daisy mine.

Ridge Mining Company, a subsidiary of a gulf coast oil company, reportedly has hired the McPhar Geophysical Corporation of Toronto, Canada to conduct a self potential survey around the old Emerald Isle copper deposit at Chloride, Arizona.

The Ray Mines Division of Kennecott Copper Corporation has more than half completed its overall expansion program at Ray, Arizona. The mill expansion, which includes the track hopper, conveyor systems, crusher, and mill buildings, is expected to be ready for use by April. Work on the auxiliary buildings at the reduction plant at Hayden is on schedule. The sample preparation building and

warehouse are completed. The 7,500-ton fine ore storage building at the Ray plant is complete except for details that will be finished during the crusher changeover to the reduction plant. The new Ray shop and buildings will be ready in April. Some equipment began moving into the area late in 1959. This is all part of the \$40,000,000 program which will include pit enlargement and increase in Hayden mill capacity to 22,000 tons daily.

The Office of Defense Mobilization will buy 500 tons of asbestos from Gila County, Arizona producers this year for the national stockpile. The action is expected to stimulate local mining. The Metate Asbestos Corporation reportedly plans to reopen its Emasco mine in Salt River Canyon, and Jaquaco Mining Corporation expects to enlarge its crew working at two mines near Seneca. The government's program specifies low-iron, crude, soft fiber, and Gila County is the only one in Arizona producing this. One uncertain point is whether the government requires only newly mined ore, since many operators already have a stockpile on hand.

"Rocks To Riches," a story of Arizona mining—past, present, and future, has been written by Charles H. Dunning, former director of the Arizona Department of Mineral Resources. Arizona mining has been divided into nine periods, with a complete report on developments of major mines during each period. There is a special chapter on Mining Today and Tomorrow. While the book primarily covers copper, gold, lead, and zinc, there is a chapter on minor metals and non-metals. The compendium of important Arizona mines is well done. Copies may be obtained for \$8.75 each from the Southwest Publishing Company, Inc., 817 West Madison Street, Phoenix, Arizona.

The Old Bose' group of 30 unpatented claims has been purchased by the A. T. & L. Mineral Corporation of Houston,

Texas. The property is located about 6 miles west of Mammoth, Arizona. A small crew is employed in preliminary work, consisting of stripping overburden with a bulldozer, trenching, road building, and sampling. About 10 feet of overburden cover the area being checked. The company proposes to diamond drill the holdings and explore the possibilities of an open-pit copper operation. No work is scheduled for the manganese deposits worked by the previous owner, Ardith Long. Tommy Thompson, president of A. T. & L., Mammoth, Arizona, is directing the exploration program.

The old tailings dump at the Katherine mine near Kingman, Arizona, has been leased by George T. Martin who plans to recover the gold values estimated to average \$11 per ton. He proposes to sluice the material to a central pump, then raise it to an agitator from which it will flow by gravity to a series of patented tables, five of which have been installed. Final recovery will be by amalgamation.

Intermittent mining and milling operations are continuing at the Savoy mine in the Tiger district near Crown King, Arizona. This is a silver-lead property opened by a 1750-foot adit with a 100-foot raise at 1,400 feet opening into old caved workings. The mill, consisting of a jaw crusher, ball mill and concentrating table, has a capacity of about 1 ton per hour. Operations are directed by J. W. Wilkerson of Phoenix.

The main or Curtin shaft at the Swastika mine near Cleator, Arizona, is being unwatered to the 400-foot level, and a gossan area in the same vicinity is being drilled. This shaft and the caved Black Prince shaft are on the main silver vein of the property, but present plans call for exploration of a parallel copper vein about 600 feet to the north. The Swastika is controlled by W. A. Hayes of Oakland, California, and associates. William White is superintendent at the mine.



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SOUTHWEST

CALIFORNIA



Jefferson Lake Sulphur Company has exercised its option to acquire a major chrysotile asbestos deposit, located near Stockton, California, from American Asbestos Company. The company had done 25,000 feet of diamond drilling, and had proven 15,000,000 ton of ore. Analysis had shown that the fiber was similar to Canadian chrysotile fiber. A 2,000-ton-per-day mill is to be installed which will supply about one-third of California consumption which presently is imported from Canada and Africa.

A new \$1,350,000 facility for topographic mapping in eight western states has been opened by the United States Geological Survey at Menlo Park, California. Equipment and personnel were transferred from the former quarters at Sacramento. The new installation is designed to produce approximately 40 new or revised topographic maps each month. It takes about three years to complete each one and about 1,500 Pacific area map manuscripts are in process at all times. These maps become quadrangle sheets of the National Topographic Atlas. About 45 percent of the country is now covered.

The merger of Goldfield Consolidated Mines Company and American Chrome Company has been approved by stockholders. Two shares of Goldfield stock will be exchanged for each share of American Chrome.

Calaveras Cement Company, a division of Flintkote Company, will build a \$14,000,000 cement plant at Redding, California. Completion is expected by March 1961. The plant will be located on a 1,500-acre site containing limestone and shale. At the firm's quarry at San Andreas, California, two rewards were earned for a full year of quarry operation without lost-time injuries. The U.S. Bureau of Mines presented the awards for a 1958 record of 263,212 accident-free man hours.

The former Mojave Branch of the Western Mining Council has been reorganized as the Southern Kern Mining Council, but will retain its affiliation with the Council.

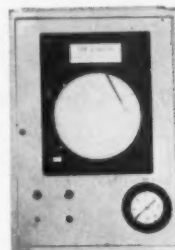
NEVADA



Sinking of a 300-foot, three-compartment shaft is planned by Nevada Rawhide Mining Company at its gold-silver-lead property near Virginia City, Nevada. Extensive surface stripping was done last season. Clarence Davis of Cheney, Washington is company president.

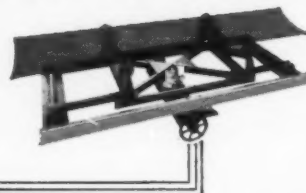
William Baker who is developing a sulphur mine at Sulphur, Nevada, reportedly plans to install a 300-ton flotation mill and have it in operation by July. Mr. Graham has 508 acres of patented land,

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which are located near the Western Pacific Railroad. He plans an open-pit operation.

NEW MEXICO

Kerr-McGee Oil Industries Inc. has received a new uranium concentrate purchase contract from the AEC for continued operation of its 300-ton-per-day uranium processing mill at Shiprock, New Mexico. The new contract runs from November 1, 1959 to June 30, 1956, or to an earlier date when Kerr-McGee will have delivered the maximum number of pounds of concentrate provided in the contract. The plant is shut down at present for construction of a new solvent extraction circuit to recover high purity vanadium concentrate (about 99 percent V_2O_5), as well as uranium concentrate from the Shiprock ores.

The Rio De Oro property of Hidden Splendor Mining Company delivered 2,016 tons of uranium ore from its Dysart mine in December 2, breaking its own production record. The mine is located in the south half of Section 11 in the Ambrosia Lake district of New Mexico. It has been producing up to 40,000 tons of ore per month. The property was owned by Rio De Oro Uranium Mines Inc. until its recent merger with Hidden Splendor. Ray Schultz is vice president and mine manager.

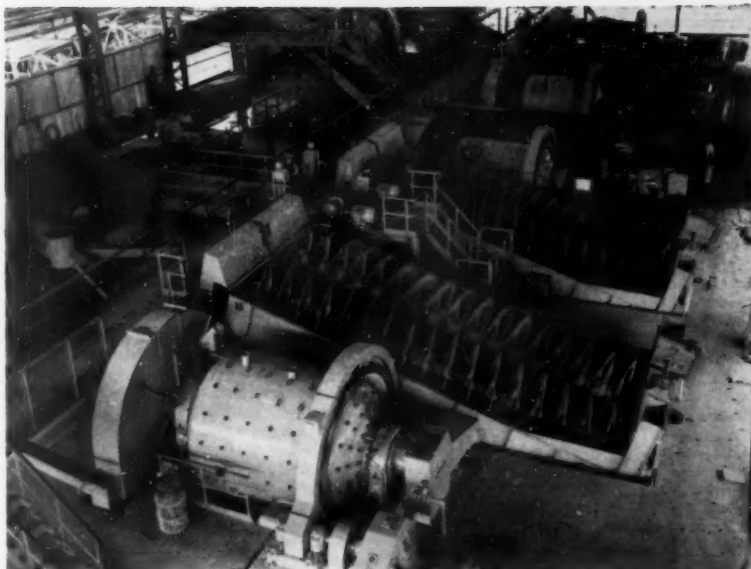
The rising volume of potash sales has led management of International Mineral & Chemical Corporation's Carlsbad, New Mexico division to do away with vacation shutdown in 1960. Present planning indicates it will be necessary to maintain continued production throughout 1960, and so vacations for employees will be scheduled throughout the year on a basis which will make full-scale operation possible.

Phillips Petroleum Company is now mining Sec. 34, T. 14 N., R. 9 W. in the Ambrosia Lake district of New Mexico which it has under lease arrangements with Ranchers Exploration and Development Company. During the first quarter of the Ranchers' fiscal years, July to September, no production was forthcoming, but about 25,000 tons was produced by Phillips in the second quarter. Ranchers' lease to Kermac Nuclear Fuels Corporation for Sec. 33, T. 14 N., R. 9 W. also brought royalties as that property went into production.

The Ambrosia Lake uranium industry has organized a collective news bureau which will publicize the district's activities. Known as the Ambrosia Lake Information Bureau, the agency will be headquartered in Grants, New Mexico, and headed by George Mason, an Albuquerque public relations man.

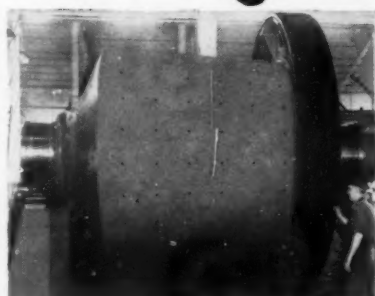
Johns-Manville Corporation has acquired F. E. Schundler & Company, Inc., of Joliet, Illinois through an exchange of stock. Schundler operates the perlite mine at No. Agua, New Mexico, 70 miles north of Santa Fe. JM hopes to become a prime supplier of crude perlite, according to company officials.

JANUARY 1960



Shown here are four Hardinge 9-3-6-8 Tricone Mills grinding sulfide copper ores and mixed ores in a concentrating plant in the Belgian Congo, Africa.

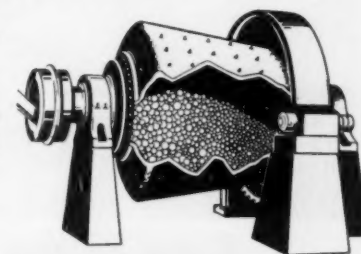
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British Columbia-Yukon Chamber Offers Variety Of Educational Mining Courses for Prospectors

The British Columbia & Yukon Chamber of Mines is sponsoring several special lectures for interested mining people living in the Vancouver area.

One series will be given in conjunction with the 42nd annual Prospector's Classes held at the Point Grey School. On January 21, F. B. Blakey, chief gold commissioner, Department of Mines, Victoria, will discuss "The Mining Laws of British Columbia." On January 26, Dr. J. M. Carr will speak on "Base Metal Occurrences in the Princeton-Merritt-Kamloops Area." On January 28, J. W. McCammon, will discuss "Industrial Minerals", and on February 2, Dr. Harry V. Warren, "Geochemistry in Prospecting". Dr. Carr and Mr. McCammon are engineers with the Provincial Department of Mines, while Dr. Warren is associated with the Geology Department of the University of British Columbia.

Lectures in Applied Geophysics will also be held in the Point Grey School, starting on February 9. This series will be sponsored by the Chamber and also the Physics Department of the University and the Adult Education Department of Vancouver School Board. Since geophysical investigations will be used more and more in the search for new deposits, this course is designed to explain the underlying principles and some of the procedures used in applying geophysics to mineral exploration.

The six lectures will discuss: geophysics in relation to geology and the discovery of

ore deposits; magnetic methods and the dip needle (given in two parts); electrical methods; and E.M. methods, Afmag, Varian, gravimeter, and radioactivity. All will be given by R. D. Russell, associate professor of geophysics at the University.

Special lectures on "Case Histories" will be presented as follows: February 25 and March 1, Application of magnetometric methods, methods of interpretation, maps and profiles, relation between geology and geophysics, by Dr. J. M. Black and Ralph C. MacDonald, exploration geologists; March 3, Discussion of electrical methods, induced polarization, resistivity and self potential methods, by Dr. Don A. Hansen, consulting geophysicist; March 8, Discussion of E.M., Afmag, Turam, and Varian, by Morris M. Menzies, exploration geologist.

For further information on any of these courses, contact the Chamber of Mines at 840 West Hastings Street, Vancouver 1.

Indian Group Sponsors Pilot Plant Symposium

The Indian National Metallurgical Laboratory is sponsoring a Symposium on Pilot Plants in Metallurgical Research and Development at Jamshedpur, India from February 9 through 12. The Lab has been organizing symposia regularly on subjects of metallurgical interest and of topical importance.

The National Metallurgical Laboratory believes that pilot plant techniques are of vital importance in metallurgical research and development generally, and to India in particular. A Rupees 30 lakhs pilot plant project on low shaft furnace operation for smelting iron with non-metallurgical fuels has already been put into operation by the Lab in collaboration with the metals committee of the Council of Scientific and Industrial Research. There are also a number of processes being developed by the Lab based on indigenous materials, such as the low shaft furnace project, pilot plant production of steel by l-d process, semi-pilot plant studies on the production of electrolytic manganese, electrolytic manganese dioxide, beneficiation of ferruginous manganese ore.

The scope of the February Symposium will broadly cover the relation of pilot plants to large-scale industrial application; types of pilot plants; analysis of pilot plant data; pilot plant projects underway in India and other countries. It will provide an opportunity for an exchange of technical information by leading scientists and metallurgists from different parts of the world.

Ivory Coast Mineral Exploration Under Way

The government has decided to intensify mineral exploration in the Ivory Coast which has received less attention than other sectors of French West Africa. Until now, the only minerals found had been gold and diamonds. Now, however, an important deposit of manganese has been discovered about 40 kilometers northwest of Grand Lahou. Some indications of iron have been found in the west and north-west parts of the country.

One of the great difficulties in prospecting is that a large part of this country is covered with forest and lacking in access roads. Also, the surface soil is largely lateritic which hides the geological formations and requires a modifying of standard prospecting techniques.

In order to stimulate mineral prospecting, the government has created an office of geology and mineral prospecting. This office has decided to study geological formations in the northwestern part of the country (Odienné-Bundiali) and in the Sasca, an unexplored region in the southwestern part of the country, between the Sassandra and Cavally Rivers.

Also, the Bureau des Recherches Géologiques et Minières is exploring southwest and central parts of the Ivory Coast (Yaouré region) in collaboration with government agencies. In the northwest part, the Bureau is working with the European Community of Coal and Steel in a vast exploration program for iron and manganese. Some indications of iron ore also have been found in the Nimba Mountains and near the Sassandra River in the western section.

Finally, the Aluminum Company of America has been given a concession to explore the coastal region of Davo, Lakota, and Sassandra for bauxite.

The government is now preparing a three-year plan for economic development of the country. This plan contains, notably, an important minerals exploration program.



Kiruna Sampling Plant in Operation

The new sampling (sample, crushing, and preparation) plant of Luossavaara-Kiirunavaara A.B. at Kiruna, Sweden is now in operation. Initially, the plant prepares 300,000 samples per year. When a new analytical laboratory is completed, the sampling plant will prepare 1,000,000 samples per year for analysis. In the photograph above, the building to the left receives the ore and prepares the coarse samples; the building to the right is for drying, splitting, and pulverizing; the middle silo receives the discharge from sampling. Each railroad car of ore and concentrates pulls through the building at the left for sampling, on its way to the shipping port of Narvik. While the train is making the trip to the port, the laboratory analyzes the samples and wires the results to the port, so that cars can be blended for ship loading.



MALAYA—Sungei Besi Mines Ltd. and the adjoining Hong Fatt mine have merged (see *MINING WORLD*, November 1959, page 81) and plans are now being made regarding future operational activities. Machinery similar to that used at Sungei Besi will be installed at Hong Fatt. This should be completed by the end of 1960. When the **Pelepah** dredging section of the Sungei Besi mine can resume production, depending on future tin export quotas, the three properties are expected to yield substantially higher profits than are currently being obtained.

CEYLON—The government has finally reduced the export duty on graphite after much agitation by the industry so that it could meet severe foreign competition. The reduction from Rupees 50 to Rupees 20 per ton has been mildly received, however, because miners had been asking for complete removal of the duty and reportedly they are not certain this present relief will be adequate.

INDIA—Development of the West Reef in **Nandydroog** gold mine in Mysore state continues to be successful. In the **Champion Reef** mine, however, no new ore shoot of economic value has been discovered and development of work has been suspended. The government of India has decided to acquire the entire production of the **Mysore** gold mines at the official rate. The decision was made, according to the Minister of Finance, in order to strengthen the country's gold reserve. The cost of production in these mines is higher, and the government reportedly is considering giving some subsidy.

JAPAN—A promising uranium discovery has been made north of Lake Tazawa in Akita Prefecture. It is said to compare favorably with that of Ningyo Pass in Tottori Prefecture. The uranium find was made in a tunnel for a road near Tazawa, and was contained in breccia in tertiary period facies. Its content is believed to be from 0.4 percent to 0.64 percent, higher than the Ningyo Pass deposit which averages about 0.05 percent. Other discoveries have been made at Asahimura, Yamagata prefecture, and in Nakajo.

BURMA—The government has decided to establish an atomic energy center and nuclear radiation laboratory. Both are now under construction. The lab will serve as the first main laboratory for the handling of radio isotopes. A coordinated effort is being made with geologic groups in Burma to search for uranium ores.

INDIA—The total reserves of copper ore proved so far by the **Geological Survey of India** total about 3,370,000 tons. Encouraging results have also followed the intensive survey carried out by the GSI in the copper belts of Rajasthan, Uttas Pradesh, Bihar, and Andhra. The **Indian Bureau of Mines** is carrying out detailed investigations at Khetri and Dariba for the economic workability of these deposits. A special base metals wing

has been formed in the GSI to intensify the exploration for copper, lead, and zinc. The output of copper ore during 1958 was 450,000 tons.

JORDAN—The **Jordan Phosphate Mines Company** expects to have an average annual output of 1,000,000 tons of phosphate by 1961. Production in 1952 was 10,000 tons; then 150,000 tons in 1955, and 300,000 tons in 1958. Present reserves of phosphate ore in Jordan are estimated at 80,000,000 long tons. A part of the expansion program planned by Jordan Phosphate includes erection of a superphosphate plant. A study was recently completed of the Arab World's requirements for fertilizer. The plant will cost \$2,800,000 and will use imported sulphur to make sulphuric acid and local gypsum to make the superphosphate.



NORWAY—As a result of the encouraging work done last summer in the Bidjovagge and Suovra-Rappat copper districts of northern Norway, **Kautokeino Kobberfelter** has decided to undertake a full-scale copper project. A surface building will be erected, mine developed, and flotation mill constructed. Because the deposits are located on a high vast plateau, only barracks for miners will be built at the site; homes will be located along the sea, and workers will live in the barracks

only during the working week. A production of 150,000 tons of ore per year is planned, containing 2 percent copper. Flotation tests have yielded a concentrate with 25 percent copper. Plans are to drive a 900-foot-long adit from the inland Reisa Valley located 75 miles from the sea, and at an elevation of 1,500 feet. The concentrates will be sent by trucks to the sea, and the road is to be kept open all winter.

YUGOSLAVIA—The country's largest iron and steel works is being built in Skopje, Macedonia. Completion date is expected in 1972, at which time the plant's output should be 760,000 tons of pig iron, 970,000 tons of steel, and 663,000 tons of finished products. Macedonia contains about 40 percent of all the iron ore reserves in Yugoslavia.

SPAIN—An iron ore mine with reserves estimated at 10,000,000 tons is being developed in Lugo by the Asturian company. The company took out over 20,000 tons in early development work, and plans to produce 500 tons daily when in full production. Samples taken have shown average content to be 56 percent Fe and 8 percent silica. Exports are expected to be high later this year. British buyers have already ordered 60,000 tons, and ore buyers are expected from Germany, too, where stocks have dwindled in the last two years.

Ermita section. Operations at **Argimela**, about 25 miles away, are still in an exploratory stage, for the most part, but are now virtually self supporting. A further expansion of development work is planned, as well as improvements and extensions of the milling plant, and within a year or two the property is expected to



Find More Copper for Japanese Refinery

Dowa Mining Company has discovered a large copper deposit at its Tainan properties near its Kosaka operations in Akita Prefecture, Japan. Until now, the firm's electrolytic refinery (shown above) had been treating ore from the Kosaka mine, which was rapidly being depleted, and the Hanaoka mine, with additional purchases of imported ore. The new discovery has an estimated ore reserve of 1,300,000 metric tons containing 3 to 4 percent copper. The plant incorporates a Fluosolids roasting system and acid leaching of copper solution to form electrolyte for electrolysis. It produces 1,400 metric tons of copper per month. Under construction at Dowa's nearby Hanaoka mine is a 20,000-metric-ton-per-month flotation mill which is to be completed in June or July at a cost of 80,000,000 yen. The Hanaoka plant will then be able to treat 35,000 to 40,000 metric tons of copper per month, compared with the present 15,000-metric-ton output.

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AUSTRIA—The copper mine at Buchberg near Bischofshofen, province of Salzburg, is closing down because of depletion of the ore body. Previously it had been expected that the reserves would last through 1960 or 1962.

PORTUGAL—Beralt Tin & Wolfram has been trying out different mining and milling methods in its Vale da Ermida mine section and Panasqueira mill. Tin occurs in large quantity, but the grade is too low for the mine to be worked profitably by ordinary underground methods at present tin prices. Thus, the firm is experimenting and it will be some time before it can be determined whether continued operation will be economical. The tungsten mining section is restricted to quantity needed under a long-standing contract, and thus much of the mining force has been transferred to the Vale da Ermida section.

THE NETHERLANDS — The European Association of Exploration Geophysicists has published a volume devoted to case histories of mining exploration projects, water investigations, and civil engineering problems. Entitled "Geophysical Surveys in Mining, Hydrological and Engineering Projects—1958," it will sell for \$4.50. (N. fls. 16.50); however, members of the Association and of Society of Exploration Geophysicists may purchase it for \$3.50 (N. fls. 12). Address requests to B. Baars, secretary-treasurer of the association, at 30, Carel V. Bylandlaan, The Hague.

SPAIN—The new smelter of Espanola de Zinc in Cartagena is expected to go into operation during the first quarter of 1960. It will treat 40,000 tons of concentrate to produce 20,000 tons of zinc ingots. The firm belongs to the Celdran-Banco Central group; the smelter is being built with German assistance.

CZECHOSLOVAKIA — In the third Five-Year Plan (1961-1965) total production of the national economy is to be increased by 50 percent. The main task under this plan is to be development of the metallurgical industry. In 1965, the work week in the mines is to be reduced to 40 hours.



SOUTH WEST AFRICA—The South West Africa Company Ltd., a producer of lead-vanadium concentrates from its Berg Aukas deposits, has installed a new flotation plant which is being commissioned. Exploration in the area has yielded encouraging results. At the Brandberg West tin-tungsten deposits, producing facilities have been modified and should soon be commissioned to handle 20,000 tons of ore per month.

BELGIAN CONGO—Operations at Union Minière du Haut Katanga have not been affected by the political situation, and copper output for 1959 is expected to reach 270,000 metric tons, compared

with an output in 1958 limited to 235,000 tons. The new Luilu plant will reach a first stage output at the rate of 50,000 metric tons of copper and 1,750 tons of cobalt annually toward the middle of this year or earlier than anticipated. As a whole, the company expects that the present program should enable a progressive increase of copper output.

MOROCCO—The Moroccan-American Development Company of Casablanca has leased a graphite and vermiculite deposit from a Spanish firm, Mauretania S.A. The 17-square-mile concession area is located 25 miles from Tetuan in north Morocco. The new lessees reportedly plan to invest \$2,000,000 in the first year of development, at the end of which 1,000 tons monthly is expected to be mined. A milling and refining plant are to be installed, and the firm hopes to build a wharf at the nearby beach so that ore could be shipped directly instead of being trucked to Tetuan as the former operators did. The graphite deposit is said to contain 1,500,000 to 2,000,000 tons in reserve. The vermiculite deposit is adjacent to the graphite, but has not developed.

UNION OF SOUTH AFRICA—Free State Saaipolans Gold Mining Company Ltd., which has already installed underground pumping capacity of 5,500,000 gallons a day at No. 1 shaft, will install a similar capacity at No. 2, and will increase the capacity from time to time as required. The company does not expect the khaki shale marker band in the hanging wall to pose difficulties within the lease area. Initial production remains scheduled for about mid-1960.

AFRICA—In its intensive and far-flung program of exploration, Consolidated Gold Fields of S.A. Ltd. has reported the discovery of extensive deposits of phosphate rock in East Africa. Prospecting is continuing in order to evaluate the find. At the Kiabakari gold mine of the Tangold Mining Company Ltd. in Tanganyika, the reduction plant, commissioned early this year, is nearing capacity production. At G.F.K. Refractories Ltd. in Kenya, operating difficulties in the new plant recently commissioned have necessitated further experiments and research. However, output and sales of kyanite concentrates are continuing.

FEDERATION OF RHODESIA & NYASALAND—The Rhodesian Selection Trust Group reveals that average cost of production from its Roan Antelope, Mufulira, and Chibuluma mines ran about 17 to 19 cents per pound during the fiscal year ended June 30, 1959. For the first quarter of the 1960 fiscal year (quarter ended September 30, 1959) Roan Antelope produced 21,007 long tons of copper, compared with 25,598 in the previous quarter and 15,647 in the same quarter of last year; Mufulira produced 26,183 long tons, compared with 26,699 in the previous quarter and 18,570 in the same quarter of last year; Chibuluma produced 5,601 long tons, compared with 6,352 in previous quarter and 3,741 in same quarter of last year.

TOGO TRUST TERRITORY—The Togo Benin Mines Company is planning to develop calcium phosphate beds at Akoumpe. Known reserves there are reported at about 50,000 tons of ore containing 65 percent tricalcium phosphate.

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The ore will be upgraded to about 80 percent. Construction of the washing plant, electric power plant, 700-meter bridge, and 20-kilometer railroad have already started. Initial output will be 600,000 tons of concentrates per year; it will be expanded to 750,000 tons later.

UNION OF SOUTH AFRICA—West Driefontein Gold Mining Company has embarked upon a £9,000,000 expansion program which will be spread over the next five years. In about two to three years, the company will sink a subvertical shaft from the southern extension of No. 3 shaft workings. At about the same time, sinking of the second No. 5 subvertical shaft will be initiated in the

extreme southwestern section. Early this year, sinking of the No. 4 shaft in the northeastern section will be resumed. Initial development in the Ventersdorp Contact Reef in the southwestern section and the recent drilling results in the central east section have indicated that this somewhat erratic horizon is more consistently mineralized than previously anticipated.

MOROCCO—To increase cobalt production, an expansion program has been completed at **Societe Miniere de Bou Azzer et du Graara's** deposit at Bou Azzer. A 30-kilometer pipeline has been installed; some pumping installations constructed; an electric plant with a

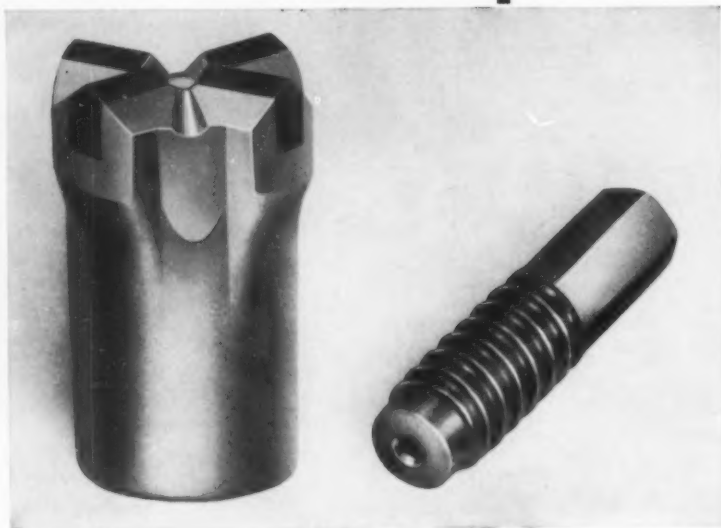
4,000-kva capacity erected; and a large washing plant built. The production of concentrates rose from 4,230 tons in 1957 to 9,250 tons in 1958. During the first nine months of 1959, this output reached 9,000 tons, or 1,000 tons per month. All of the production is exported to France and Belgium.

UNION OF SOUTH AFRICA—Dominion Reefs (Klerksdorp) Ltd., essentially a uranium producer, has found that additional gold can be recovered economically and so it is installing a flotation plant for production of a pyritic concentrate from the milled mine ore prior to the treatment of the pulp in the uranium plant. This concentrate then will be cyanided. The new plant, to be commissioned early this year, is expected to earn additional profits of about £2,500 per month. Previously the pulp from the mill was run over corduroy tables prior to transfer to the uranium section. To extract gold from the residue from the uranium plant would not be economical because of the high proportion of accumulated residues in the overall feed to the uranium plant.

GHANA—Further rich gold values are being encountered at **Ashanti Goldfields Corporation's** property. Among them, the 34 north level of the Main Reef in crosscut 26 west has given 64.2 dwts gold per ton over a width of 5.5 feet. Several high values on the Ayeinm Reef include 13.5 dwts, over 20.8 feet on the 7 south level in crosscut 10 west. Down on the 12 south level, crosscut 151 west has given a width of 38 feet containing 7 dwts gold. For the year ended September 30, 1959, the firm made a record profit of £1,574,984, subject to taxes.

FEDERATION OF RHODESIA & NYASALAND — Rio Tinto (Southern Rhodesia) Company, in association with R. W. Rowland, has acquired a 100 percent holding in **Vulcan Minerals (PVT)** which owns an emerald deposit and certain mineral claims in the Belingwe district, some 120 miles west of Bulawayo. Rio Tinto intends to carry out a full geological and mining survey and, in consultation with the Southern Rhodesian government, will give attention to the highly specialized business of marketing these gems. Rio Tinto has also acquired **Leslie Gold Mines** whose wholly owned subsidiary, **Armour Mines and Minerals (PVT)**, owns Patchway mine, 12 miles north of Gatooma. The current milling rate is about 3,000 tons of ore per month and recent investigations by Rio Tinto have indicated possibilities of expanding the mine. The firm has also acquired the **Big Ben** gold mine, 7 miles east of the Patchway. Only a small tonnage of high-grade ore is being milled now, but exploratory work has been carried out and there are possibilities that additional ore bodies are available, making it possible to step up production.

UNION OF SOUTH AFRICA—S.A. Land and Exploration Company Ltd., in the Witbok area immediately south of its existing lease area, has received a lease covering 4,495 claims and plans to sink a shaft system. The new area seems to form a natural extension of the payable reef on its existing property. A vertical shaft will be sunk about 4,260 feet, and a subvertical shaft about 7,350 feet. Pumping capacity will be increased. Cost of the program is estimated at £3,109,000.



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OCEANIA

QUEENSLAND—Dewey and Almy Overseas, a subsidiary of W. R. Grace and Company, is considering the possibility of producing ammonium sulphate from pyrites of Mt. Morgan Ltd. If the report is favorable, the U.S. firm will build a plant capable of using about 50,000 tons of pyrites annually, and will assist Mt. Morgan in obtaining additional capital.

REPUBLIC OF THE PHILIPPINES—Surigao Consolidated Mining Company has acquired the Guimaras, Pangasinan, and Lluch copper properties, and the Sta. Teresita and Pioneer iron properties. All had been developed to various degrees by other firms. The company plans to concentrate mainly on the two iron properties and the Lluch deposit, all located in Zamboanga del Sur, because they appear to have the most merit. Negotiations are under way with a Japanese firm regarding financing of work on the iron deposits.

TASMANIA—King Island Scheelite N.L. at Grassy, King Island, will reopen its mine in January on a limited scale. The company has a 12-month contract on a price basis "which should ensure a reduction in the present cost of mine care and maintenance".

SOUTH AUSTRALIA—A low-grade iron ore deposit has been drilled and mapped on Tiverton Station, 20 miles southeast of Yunta. The tonnage exceeds 100,000 and is accessible by open pit. A concentration process has to be worked out by the Mines Department laboratories.

REPUBLIC OF THE PHILIPPINES—Philrex Mining Corporation is now caving the first block in the large low-grade copper deposit at the Santo Tomas block caving project south of Baguio. Development of the underground block-cave layout has been in progress for two years. Undercutting of the first block was completed in September. Caving action was initiated immediately, subsidence occurring within one month after undercutting. Size of this first block is 100 by 160 by 250 feet high. Average metal content is 0.70 percent Cu and 0.02 ounce gold per ton. The firm is drawing about 900 tons per day from the block and the balance of the 1,800-ton-per-day mill production comes from a temporary pit operation. Headings are being driven toward the second block which is expected to be undercut in February; the third will be done in June or July.

INDONESIA—Production of tin-concentrates was slightly higher in October 1959, than in the previous three months. Output in October was 1,984 tons of fine tin. Of this amount, 1,210 tons came from Banka and 684 tons from Singkep.

QUEENSLAND—Mount Morgan achieved higher production in the fiscal year ended June 30, 1959, with gold output totaling 68,714 ounces, compared with 51,826 in the previous year, and

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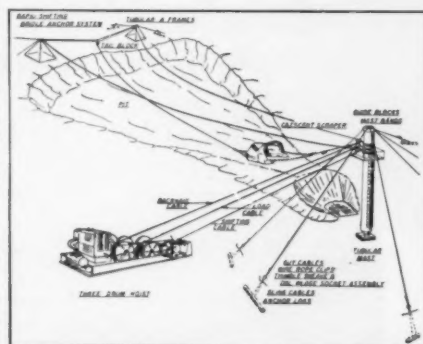
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copper 8,258 tons, compared with 7,579 in the previous year. Ore milled was 93,000 tons lower at 728,000 tons for the year. Net profits increased by £188,648 to £448,419. The firm's fortunes will continue to fluctuate with metal prices and variations in grade of its orebody. The company uses its smelter as a giant "fire assay" to collect gold. There is no cyanide process at this operation. Blister is sent to Port Kembla for refining of both copper and gold. Copper recovery is 92.3 percent but gold is only 67.8 percent because of losses in flotation.

NEW SOUTH WALES — National Minerals Ltd. expects to increase its production of rutile and zircon by 50 percent in this new fiscal year which started June 30. The company plans then to place the "largest single wet plant unit in Australia" in operation on its Redhead deposits. This wet plant reportedly is a small bucket dredge. In the past year ended June 30, 1959, the firm had another successful year, producing 5,724 tons of rutile and 4,976 tons of zircon.

PACIFIC ISLANDS — Pacific Island Mines Ltd. in the Territory of Papua will make a public share issue in order to begin investigations of the gold lodes of Misima Island (see MINING WORLD, March 1958, page 87). The company states that gold worth £3,000,000 was produced at Misima before World War II.

REPUBLIC OF THE PHILIPPINES — Despite adverse conditions, the Philip-

pine mining industry as a whole showed improvements during the last fiscal year, according to Benjamin Gozon, mines director. All metals showed increased in volume of production, except lead and refractory chrome. Mineral production was more than Pesos 200,000,000 for the third consecutive year, brought about mainly by increased sales of gold, copper, iron, cement, sand, and gravel. The gold mines showed signs of eventual survival, because of the "blocked peso" buying, said Mr. Gozon, but a sudden increase in production costs could eliminate price advantages. Metallurgical chrome and manganese producers face competition from Indian and European producers in the period ahead, and even Japan is seeking iron ore elsewhere, but there is still the possibility that the Philippines will set up its own iron and steel industry.



BRITISH COLUMBIA — Phoenix Copper Company, Ltd. is installing an additional ball mill to boost milling capacity from 700 tons to 1,000 tons daily at its operations near Greenwood. The increase is justified by development of the Ironsides mine for open-pit mining. Granby Mining Company, Ltd., Vancouver, B. C., is the parent firm.

ONTARIO — Shaft sinking has been completed at the nickel property of Fatima Mining Company in the Timmins area. The three-compartment shaft has been bottomed at 790 feet. Lateral work will be carried out on the 450 and 700 horizons. It is expected that the nickel bearing zone will be reached on the 450 level after about 130 feet of crosscutting; about 300 feet will be required on the 700 level.

QUEBEC — The Aluminum Company of Canada has sold 5,000 tons of aluminum ingots to Communist China. Approval was given by the Federal Trade Department in Ottawa, and is said to reflect recent easing of tensions between Canada and Communist China.


MANITOBA — Stockholders of Montgarry Explorations Ltd., which has a lithium property at Bernic Lake, have been asked to approve a stock exchange of two and one-half shares for one in a reorganization plan. Approval is also sought for a change in the firm's name. Kilborne Engineering Ltd. has been retained to design a concentrator with a minimum capacity of 200 tons per day at the mine site. Lithium shipments are scheduled to start to Metallgesellschaft A. G. in Frankfurt, Germany, a sales representative, later this year.

ONTARIO — Silver Miller Mines Ltd. has purchased the former Kerr Lake mine and has taken an option on the neighboring Conisil mine. The firm is seeking an extension of its own silver ore in the Law-

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son mine into Kerr ground on the 300-foot level. This level has been producing right to the mutual boundary, and extension of the drift is now underway. The drift will be driven 160 feet through Kerr ground into Conisil property, according to present plans. This will permit deep testing of the Conisil area.

SASKATCHEWAN—Potash Corporation of America, Ltd. has shut down its potash operations at Saskatoon in order to make repairs to the main shaft where water seepage is still hampering operations.


QUEBEC—An expansion program is underway at the property of Hilton Mines which will increase plant capacity from its present 50,000 tons monthly or 600,000 tons a year, to 66,000 tons monthly or 800,000 tons of iron pellets a year. New facilities are being installed to eliminate the bottleneck in the milling section, and to equalize the milling capacity with that of the crushing and pelletizing sections. Completion date is expected in April.

BRITISH COLUMBIA—Bethlehem Copper Corporation, with a copper property in Highland Valley, is reported to be seeking financial assistance from two Japanese copper producers in order to develop the mine. Nippon Mining Company, one of the firms, says the two companies were asked to contribute one-third of an estimated \$15,000,000 development cost to bring the project into production. The property is estimated to have a potential of between 20,000,000 and 40,000,000 tons of 0.8 to almost 2.0 percent copper ore.

NEW BRUNSWICK—St. Stephens Nickel Mines has almost completed its 300-foot shaft and will begin crosscutting on the bottom level shortly. One zone, called the Rogers Farm, is only 150 feet from the shaft site. The company holds 159 claims on the nickel-copper property which is near St. Stephen.

QUEBEC—Quebec South Shore Steel Corporation has signed an agreement with Koppers Company and another with Strategic-Udy Chemical and Metallurgical Processes for a proposed steel plant near Varennes. Total cost of the project would be about \$22,000,000, \$16,500,000 of which would be for the actual plant. Koppers would design and build the plant; the Strategic-Udy smelting process would be used in the plant. The iron ore would come from Quebec South Shore's Hull property in Quebec which it recently acquired from Hull Iron Mines for \$7,500,000, payable in stock. Plant capacity would be 150,000 tons of pig iron and steel products annually. Details about financing of the project have not been revealed at this writing.

ONTARIO—Queensland Explorations Ltd. and Split Rock Mines Ltd. have signed a contract with Patricia Diamond Drilling Company of Red Lake to test geophysical anomalies and known mineralized zones on their adjoining properties at Snakeweed Lake in the Red Lake Mining Division. A belt of basic intrusives and lavas is known to traverse this area and this favorable zone contains occurrences of copper, nickel, gold, silver, molybdenite, and asbestos. The Ontario and Canadian governments are jointly performing an aeromagnetic survey over a 60,000-square-mile rectangle (including



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this favorable belt) and results when released are expected to result in great prospecting activity. Funds have already been allocated by these governments to rebuild the Uchi Lake road, thus making this belt accessible to vehicular traffic. Iron Bay Mines Ltd. has optioned its large tonnage concentrating magnetic iron deposit to U.S. interests who, if they proceed with their development program to production, will have to arrange for a railway branch line to their property, 20 miles southwest of the Queensland property.

BRITISH COLUMBIA—The Wenner-Gren interests have staked more than 600 mining claims in northern British Columbia as the result of a three-year aerial survey by **Lundberg Exploration**. The area survey, from the Rocky Mountains to the Alaska border and from the Yukon border to 50 miles south of Prince George, is one of the province's richest mineral areas, according to Dr. Hans Lundberg. Asbestos, copper, mercury, iron, zinc, and nickel were found, he said.

ONTARIO—Patino Mines and Enterprises Consolidated is setting up a new subsidiary to be called **Patino Enterprises Inc.** The subsidiary will be incorporated in Delaware but its direction will come from the main office of the parent firm in Toronto and the managing director of the Canadian company, E. R. E. Carter, will be president of the new firm. The company will be primarily interested in investing and developing natural resources throughout the world.

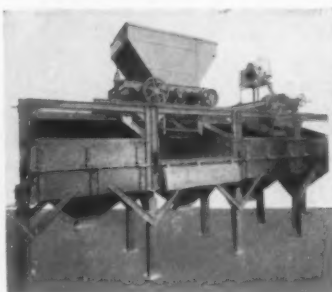
QUEBEC — Mt. Wright Iron Mines' consulting geologist has reported that the property in the Mount Wright area contains probable reserves totaling 147,339,000 long tons of beneficiating iron ore which could be recovered by open-pit methods. The tonnage is located in two deposits which have been drilled to 750 feet. Average grade in the southern deposit was estimated at 29.08 percent iron, and in the northern deposit grade was averaging 27.86 percent.

BRITISH COLUMBIA—Reeves MacDonald Mines, Ltd. is producing about 2,200 tons of zinc concentrates monthly at Remac. The firm recently resumed shipments to the Trail smelter of **Consolidated Mining & Smelting Co. of Canada** but continued sending lead concentrates to the **Bunker Hill Company** smelter at Kellogg, Idaho.



LATIN AMERICA

CHILE—Andes Copper Mining Company has officially opened its new El Salvador copper mine, located in northern Atacama Province, over 3,000 meters above sea level. Reserves are estimated at 375,000,000 tons of ore with a 1.6 percent grade of copper. Production will



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reach 200,000,000 pounds of blister copper annually, and molybdenum will be recovered by flotation. The mine is the largest copper operation to be put into production since World War II. There are 42 kilometers of tunnels and shafts. The mine is worked by block caving.

BOLIVIA—Mineral exports from Bolivia during the first half of 1959 were valued at \$32,232,745.42. Leading producers for that period were **Corporacion Minera de Bolivia**, supplying 69.59 percent of the exports; and **Mineria Mediana**, 6.58 percent.

MEXICO—**Intercontinental S.A.**, a Mexican investment bank, has joined with **Aluminum Company of America** in plans for building Mexico's first primary aluminum smelter. A new firm has been formed, **Aluminio S.A.**, to finance, engineer, construct, and operate the smelter, and market the metal. Alcoa will have a 35 percent interest in the firm, European investors 10 percent, and the Mexican firm and its associates will hold the remaining 55 percent. The smelter will be built in the state of Veracruz on a site accessible to ocean-going barges. It will produce 20,000 metric tons of aluminum annually, and is intended to serve the needs of Mexican industry.

CHILE—**Amconda Company** has announced it will install a copper refinery at the Port of Chanaral in the northern part of Atacama Province. Construction will start in June or July. The investment will be under the new Regulation of the Foreign Committee.

ARGENTINA—Two inclined shafts have been opened in the north and south deposits of the **Sierra Grande** ferrous basin in Rio Negro province where exploration is underway. Drilling and magnetometer surveying are also going on. Iron outcrops extend up to 8 kilometers in three zones and are formed by magnetite and hematite. Reserves are estimated at 16,000,000 tons of 55 to 56 percent Fe, with an additional reserve of about 70,000,000 tons. The ore contains phosphorus at about 1 to 1.3 percent, and sulphur from 0.3 to 0.7 percent, but a Swedish process is to be used so that a phosphorus slag would result which could be used in preparing agricultural fertilizers. The property was recently visited by P.A. McDonald of **Southern Cross Steel and Mining Company** and Dr. Wallace G. Fetzer of **Oglebay Norton & Company** which reportedly are negotiating with the Argentine government about a joint Argentine-United States company to develop the property.

MEXICO—Sulphur deposits have been found near the Papalopan River in the State of Veracruz, and near Huaxcala in San Luis Potosi. Huaxcala is the site of the oldest sulphur mines in Mexico. Stratigraphic studies are underway at the Huaxcala property. The Veracruz property was discovered by the late General Roberto Cejudo Valdez and is to be developed within the near future.

COLOMBIA—**Cerro de Castellon** near the Magdalena River in the Department of Antioquia will be explored by **Empresa Siderurgica, S.A.** of Medellin. Deposits in the mountain are said to contain 72 percent iron, according to preliminary surveys, and to be highly magnetic.

BRAZIL—**Companhia Mercantil e Industria Inga** at Itaguaí, state of Rio de Janeiro, has received a Cr.\$200,000,000 loan from the **Brazilian National Bank for Economic Development**. The money is to be used to build a zinc processing plant which will produce 7,200 tons of zinc ingots annually. This is about 21 percent of Brazil's consumption at the present time. The plant will produce zinc electronically, using as ore either calamine or zinc silicate. Deposits reportedly are located in Ribeira do Iguape in state of Sao Paulo; Morro do Bule, near Ouro Preto, state of Minas Gerais; and at Januaria on the Sao Francisco River, also Minas Gerais state.

COLOMBIA—In the municipality of Acandí, Department of Chocó, official proceedings are now being completed to

award 5,000 hectares of territory to a U.S. firm. The property is located in at the foot of the Darien Mountains, along the Caribbean coast. Minerals involved include principally iron ore, and also gold, platinum, and monazite.

VENEZUELA—Iron ore production during the first half of 1959 totaled 7,975,150 metric tons, 83.5 percent of which was produced by **Orinoco Mining Company**, a U.S. Steel Corporation subsidiary. **Bethlehem Steel Corporation's** subsidiary, **Iron Mines Company of Venezuela** produced 16.5 percent. These figures represent an increase of 10.3 percent over the same period of 1958. Iron ore exports amounted to 7,949,725 metric tons, or 2.3 percent more than during the first six months of 1958.

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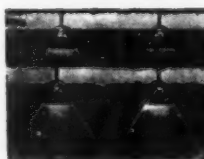
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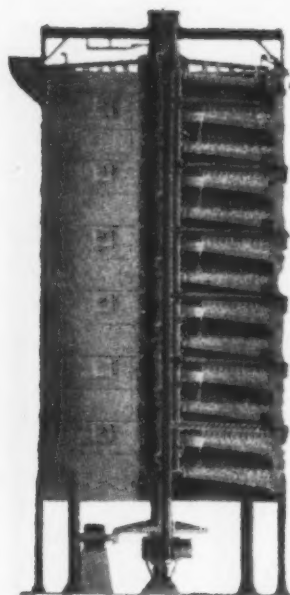
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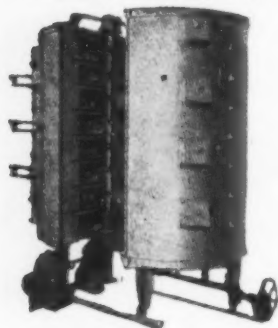


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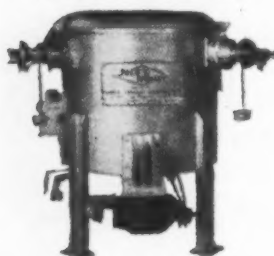
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U.S.A.

METALS

December 21, 1959

COPPER: Electrolytic. Delivered F.o.b. cars, Valley basis (pound)	33.00¢
Lake. Delivered, destinations, USA	33.00¢
Foreign. Delivered, destinations, USA	33.00¢
Custom	Nominal
LEAD: Common Grade. New York (Per pound)	12.5¢
Tri-State Concentrate, 80% lead, per ton	\$148.92
ZINC: Prime Western: F.o.b. E. St. Louis (Per Pound)	12.50¢
Prime Western: Delivered New York	13.00¢
ALUMINUM: Primary 30 Pound Ingots (99.5% plus) (Per pound)	26.80¢
ANTIMONY: Lone Star Brand. F.o.b. Laredo, in bulk (Per pound)	29.50¢
BISMUTH: (In ton lots) price per pound	\$22.25
CADMIUM: Sticks and bars, 1 to 5 ton lots Price per pound	\$1.40
COBALT: 97.99%, keg of 550 pounds (Price per pound)	\$1.75
COLUMBIUM: Powder	Nom., per pound \$55.00-\$85.00
GERMANIUM: dioxide, high purity, gram	18.50¢
LITHIUM: 98% (per pound)	\$9.00-\$12.00
MAGNESIUM: Ingots (99.8%) F.o.b. Velasco, Texas, per pound	36.00¢
MERCURY: Flasks. Small lots, New York	\$212.00-\$214.00
NICKEL: "P" Ingots (5 pounds). F.o.b. Port Colbourne, Ontario	75.50¢
PLUTONIUM: To July 1, 1962 AEC will pay \$30.00 to \$40.00 per gram depending on plutonium 240 content. July 1, 1962 to June 30, 1963, per gram	\$30.00
SELENIUM: 99.5%, per pound	\$7.00
TELLURIUM: Common grade, Per pound	\$2.50
THORIUM: per kilogram	\$43.00
TIN: Grade A Brands. New York (Per Pound) Prompt delivery	\$0.99
TITANIUM: 93.3% + Grade A-1 Sponge (Per pound)	\$1.50-\$1.60
URANIUM: Rod (0.790 U-235) \$16.00 Per Pound; Foil	\$16.75
U-235: Nominal (Per pound)	\$7.725
GOLD: United States Treasury Price	\$35.00 per ounce
SILVER: Newly mined domestic. U.S. Treasury price per ounce	90.5¢
Foreign Handy Harmon	\$93.5¢
PLATINUM: Per ounce	\$77.00-\$80.00
ZIRCONIUM: Sponge, Per pound, Reactor Grade	\$5.00

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BERYLLIUM ORE: 10 to 12% BeO. F.o.b. mine, Colorado \$46.00 per unit	
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CHROME ORE: F.o.b. railroad cars eastern seaports. Dry long tons,	
African (Rhodesian). 48% Cr ₂ O ₃ . 3 to 1 Ratio	\$35.00-\$36.00
African (Transvaal). 48% Cr ₂ O ₃ . No ratio	\$28.00-\$32.00
Turkish, 48% Cr ₂ O ₃ . 3 to 1 chrome-iron ratio	Nominal
U.S. Government ore-purchase depot Grants Pass Oregon. Buying suspended, quota filled.	
COLUMBIUM-TANTALUM ORE: Per Pound Pentoxide Nominal	\$1.00
IRON ORE: Lake Superior. Per gross ton Lower Lake Ports	
Mesabi, Non Bessemer, 51.5% Fe	\$11.45
Mesabi, Bessemer, 51.5% Fe	\$11.60
Old Range Non Bessemer	\$11.70
Old Range Bessemer	\$11.85
Swedish, Atlantic Ports, 60 to 68% Fe Contracts, Per Unit	25.00¢
MANGANESE ORE: Metallurgical grade, 48 to 50% Mn Long ton unit	\$0.95-\$1.00
Metallurgical grade, 46 to 48% Mn. Long ton unit	\$0.90-\$0.95
Metallurgical grade, 44 to 46% Mn. Long ton unit	\$0.80-\$0.85
Domestic U.S. Government. GSA Basis \$2.30 per unit for 48% mn.	
MOLYBDENITE CONCENTRATE: 90% MoS ₂ F.o.b. Climax, Colorado. Per pound Mo, plus container cost	\$1.25
TUNGSTEN CONCENTRATE: Domestic, 60% WO ₃ Per short ton unit	\$23.00
Foreign: 65% WO ₃ Per short ton unit (Scheelite)	Nominal \$16.00
Foreign: South American, Spanish, Portuguese	Nominal \$15.00
URANIUM ORE. F.o.b. purchase depot or company mill in accordance with AEC schedules and company buying contracts. Basic price is \$1.50 per pound of U ₃ O ₈ in ore assaying 0.10 percent. For each additional 0.01 add 20¢. Subject to development allowance, premiums, penalties where applicable.	

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PERLITE: Grade: F.o.b. mine per short ton	\$3.00 to \$5.00
Plaster grades. Crushed and sized. F.o.b. plants	\$7.00 to \$9.00
SULPHUR: Long ton, F.o.b. Hoskins Mound, Texas	\$25.00
Export	\$24.00-\$25.00

London

December 21, 1959

	Per Long Ton	USA Equivalent cents per pound*
COPPER: Electrolytic spot	£252	0s 0d 31.50¢
LEAD: Refined, 99%	£ 72	2s 6d 9.02¢
ZINC: Virgin, 98%	£ 95	5s 0d 11.91¢
ALUMINUM: Ingot, 99.5%	£186	0s 0d 23.25¢
ANTIMONY: Regulus, 99.6%	£197	10s 0d 24.69¢
TIN: Standard, 99.75%	£788	0s 0d 98.50¢
TUNGSTEN: Long ton unit	150s	\$19.00

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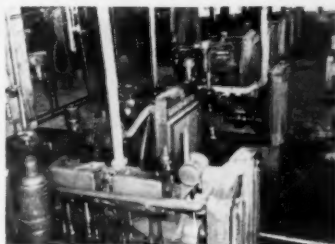
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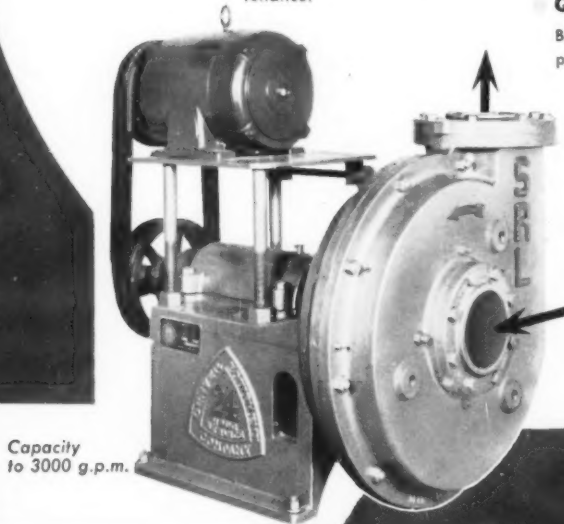
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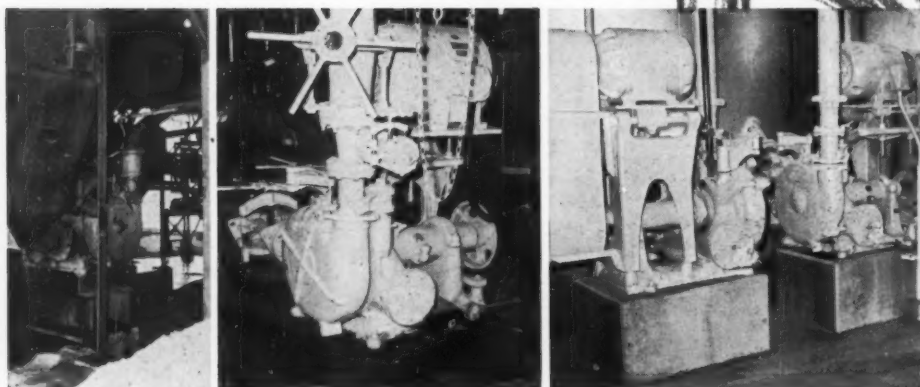
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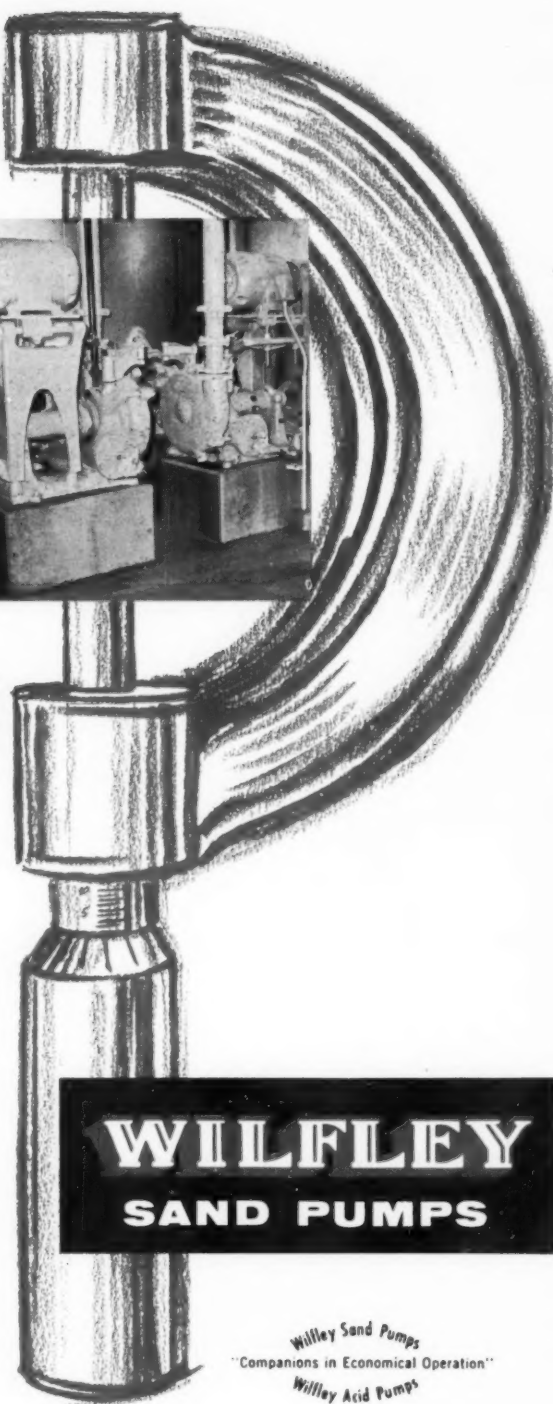
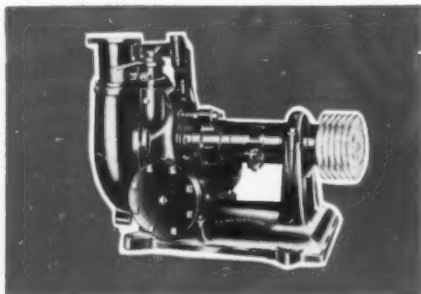
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